CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

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Yuecheng Coal Mine Methane Power Generation Project

Version 01	Original version	25/03/2011
Version 02	Revised according to DVR	25/08/2011
Version 03	Revised according to DOE comments	20/01/2012
Version 04	Revisions for TR	07/03/2012
Version 05	Revisions following incompleteness notification	9/9/2012
Version 06	Revisions following requesting for review	18/12/2012

A.2. Description of the project activity:

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Yuecheng Coal Mine Methane Power Generation Project (hereafter referred to as "the project") is to capture and utilize the coalmine methane (CMM) from the Yuecheng Coal Mine located in Jincheng City, Shanxi Province, China. Jincheng Runhong New Energy Power Co.,Ltd (the "project owner") will construct the power stations for power generation from CMM in the Yuecheng coal mine. Jincheng Runhong New Energy Power Co.,Ltd is a private company (*independent from the coal mine*) established to develop CMM utilization project.

The output capacity of Yuecheng Coal Mine is 1.5 million tonnes coal per year. There are no CBM drainage activities planned or implemented at Yuecheng coal mine. Three CMM drainage stations have been installed with averaged drained CMM concentration 35%[1]. According to FSR, every year the average amount of drained CMM from Yuecheng Coal Mine is up to 240 million m^3 which composes up to 80 million m^3 of pure CH_4, at present the majority of drained CMM is vented into the atmosphere, some amount of the pure CH_4 from the drained CMM is provided to nearby residents and gas boilers used as a support heat supply at Yuecheng coalmine and other associated mines within the Jincheng Coal Group (Jincheng Coal group is composed of different coalmines including Yuecheng coal mine).

The project participant will install 20 sets of 1000KW generators with a total capacity of 20MW.The measured and predicted gas extraction will be sufficient to supply the project and will not impact present usage. According to the FSR, the proposed project is estimated to use 45% of the pure CH_4 from the drained CMM from Yuecheng Coalmine. Waste heat from the power generation process is to be recovered and utilized by local residents free of charge for domestic purposes. As no revenue is made from doing so, emissions reductions are not calculated, and static investment in the waste heat recovery equipment is not included in the financial analysis, this activity is considered to be outside the project boundary.

The baseline scenario of the proposed project activity is the situation where the majority of the extracted

[1] The "CMM component analysis report" issued by Jincheng City Gas Testing center on 23 Dec 2009 (Report number is J091223.12, the report was made according to the GB/T13610-2003 standard) was undertaken to demonstrate that the FSR methane concentration estimate of 35% is reasonable. It shows on p.2 of the report, the content of CH_4 is 34.4394%, therefore 35% is a reasonable estimate.

coalmine methane is released into the atmosphere. A full analysis of CMM drainage and use is provided in Sections B.2 and B.4 of this report.

The proposed project is to utilize the CMM for electricity generation. The project owner of the proposed project has entered the gas purchase and supply agreement with the Coal Mine owner (project owner is different from mine owner). Such agreement will secure the supply of the CMM for the proposed project. Although the selected baseline scenario involves the venting of CMM to the atmosphere by the mine owner, the CMM does have a commercial value related to it's calorific value, therefore, the project owner needs to purchase it from the mine owner based on reasonable market value. As per Paragraph 11 of Annex 59, EB 51, greater than 75% of electricity generated, net of supply to the Yuecheng coalmine (3600MWh/yr) via the grid and project plant auxiliary consumption (10% of annual gross generation), will be exported to the Shanxi Provincial Power Grid, which is a part of the North China Power Grid. The '*Grid connection approval'* issued by Shanxi NDRC on 17th May 2011, gives the project approval to supply power to the NCPG.

The project mitigates greenhouse gas emission via the combustion of CMM. Furthermore, the utilisation of CMM enables electricity generation from an otherwise vented gas source. The electricity will partially displace electricity generated by the fossil-fuelled power plants connecting to the North China Power Grid. The expected total annual power generation is 115,200MWh, of which 10% of this amount is self used by the project as auxiliary consumption, leaving the remaining 103,680MWh of electricity to be exported to Yuecheng coalmine and other end users via the North China Power Grid. The average annual emission reductions of the proposed project are estimated to be 546,271t CO_2e.

The project will contribute to sustainable development in a number of ways:

- Significantly reducing the emissions of CH_4 from mining activates and avoid the CO_2 emissions created from coal fired electricity purchased from the Grid;
- Reducing the NO_x and SO_2 emissions that are often accompanied with coal-fired power generation. As a result, the local air quality will be improved effectively;
- Energy can be used more economically, which will promote the technology development on comprehensive utilization of mine resources;
- Contribute to the safety of coal mine operation;
- Provide working opportunities to local residents.

A.3. Project participants:

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Name of Party Involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
People's Republic of China (host)	Jincheng Runhong New Energy Power Co.,Ltd	No
United Kingdom of Great Britain and Northern Ireland	Originate Carbon Ltd	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

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People's Republic of China

A.4.1.2. Region/State/Province etc.:

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Shanxi Province

A.4.1.3. City/Town/Community etc:

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Qinshui County, Jincheng City

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

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The project is located in Yuecheng coal mine, Qinshui County, Jincheng City of Shanxi Province. Its geographic coordinates are: N 35°36'08'' and E 112°35'10''. The specific location of the project is defined in the following figure.

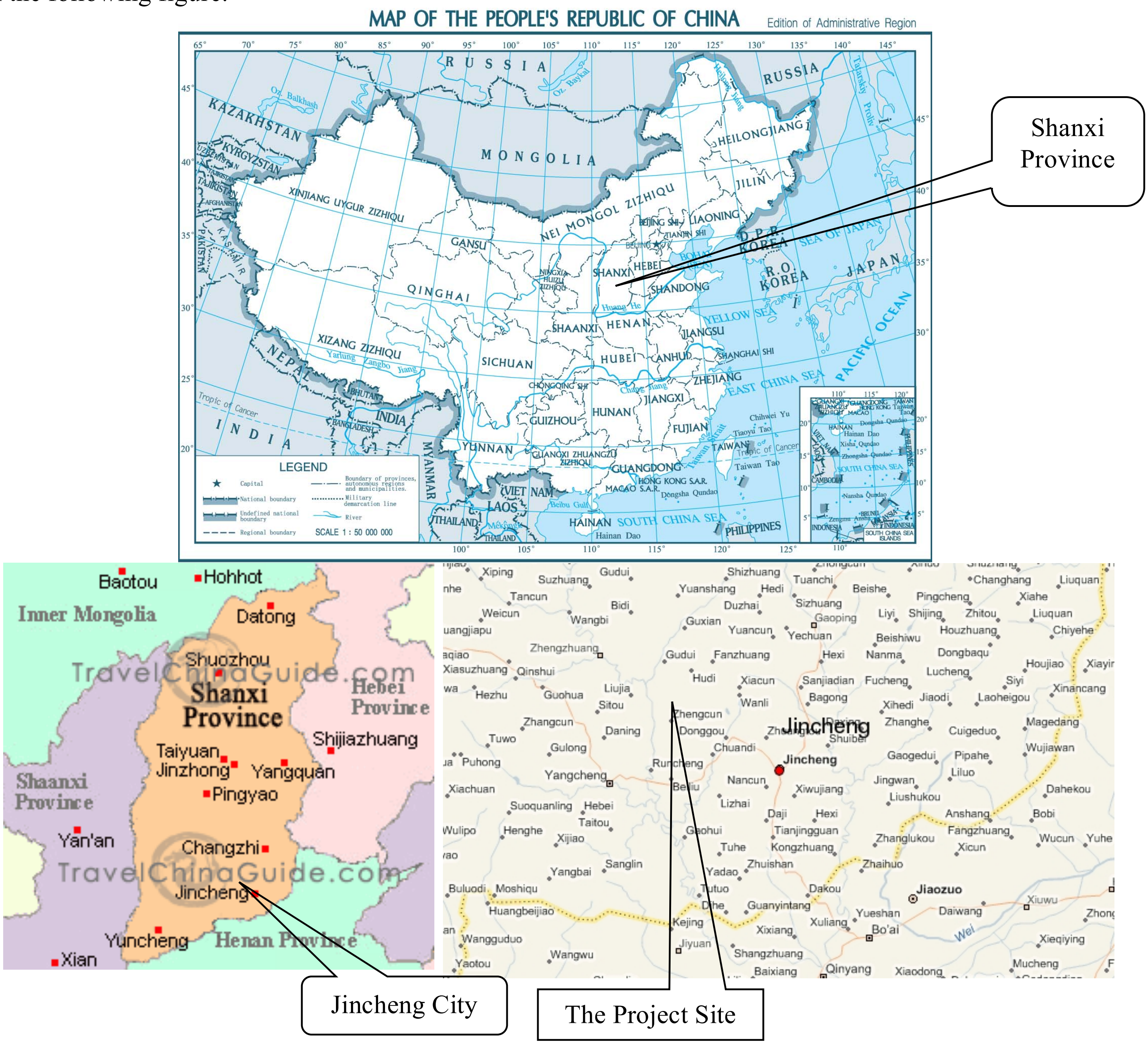

Figure A.4-1 Map showing the location of the project activity

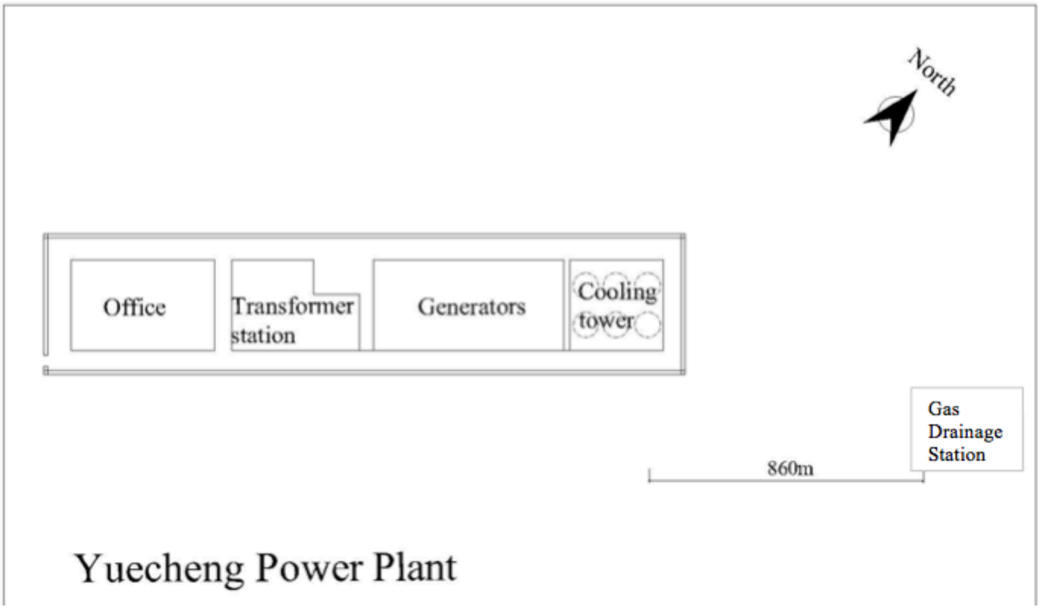

Figure A.4-2 Figure showing the location of the gas drainage station

A.4.2. Category(ies) of project activity:

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Sectoral Category 8: Mining and mineral production
Sectoral Category 10: Fugitive emissions from fuels (solid, oil and gas)

A.4.3. Technology to be employed by the project activity:

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Prior to the implementation of the project the majority of extracted coalmine gas was released into the atmosphere (a proportion of methane was consumed onsite by coal mines and local residents).

This project involves gas pre-treatment equipment, power generation station, power distribution system as well as relevant monitoring meters.

The pre-treatment performed on the CMM received from Yuecheng Coalmine involves the physical filtration of dust and water from the gas and pressure regulation valve. The Yuecheng power plant will install domestic combustion engines that will utilise CMM as fuel. In total, 20 gas generators with 1MW capacity will be installed. The recovered CMM will be pumped to the gas tank in the power plant and will be cleaned. After that the gas will be delivered to the compressing station and then injected to the gas generators for power generation.

Generator sets:
The model of the machine is scheduled to be 1000GF9-WK from Jichai. The capacity for a single machine is 1000KW. The equipment and technology adopted are advanced, mature and reliable, and have been

successfully applied in other power generation CDM projects. Technical parameters of the generator sets are shown in Table A.4-1.

Table A.4-1. Technology specifications of the generator sets

Items	Parameter
Generator sets model	1000GF9-WK
A. Gas engine	
Model	H16V190ZLW-2
Rated rotational speed	1000rpm
Rated power	1100kW
B. Generators	
Model	JFG 5603-6/10500
Type	
Rated power	1000KW
Rated voltage	10500V
Rated current	75.5A
Rated frequency	50Hz
Power factor	0.8 (lagging)
Rated rotational speed	1000r/min
Renewal period (main equipment lifetime[2])	11 years

No technology transfer occurs in the project.

A.4.4 Estimated amount of emission reductions over the chosen crediting period:

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Fixed crediting period (10yrs) is selected for the project activity. The estimated emission reductions of the project activity will be 5,462,707 tCO_2e over a 10-year crediting period.

Years	Estimation of annual emission reductions in tonnes of CO_2e
1/12/2012 – 31/12/2012	37,161
2013	455,226
2014	557,419
2015	557,419
2016	557,419
2017	557,419
2018	557,419
2019	557,419
2020	557,419
2021	557,419
1/1/2022 – 30/11/2022	510,967
Total estimated reductions (tonnes of CO_2e)	**5,462,707**
Total number of crediting years	**10**

[2] "*Yuecheng generator life evidence*" issued by Jichai Green Power Equipment Co Ltd (the manufacturer) on the 21st July 2011.

Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	**546,271**

A.4.5. Public funding of the project activity:

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No public funding from Annex I party has been used by this project activity.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

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This project applies approved consolidated baseline and monitoring methodology ACM0008 Version 07, "Consolidated methodology for coal bed methane, coal mine methane and ventilation air methane capture and use for power (electrical or motive) and heat and/or destruction through flaring or flameless oxidation".

Similarly, the monitoring plan has been designed on the monitoring methodology ACM0008 (Ver. 7), "Consolidated baseline methodology for coal bed methane, coal mine methane and ventilation air methane capture and use for power (electrical or motive) and heat and/or destruction through flaring or flameless oxidation".

Additionally, this project refers to;
"Tool to calculate the emission factor for an electricity system" (Version 02.2.1); and
"Tool for the demonstration and assessment of additionality" (Version 06.0).

For more information regarding the methodologies, please refer to:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

B.2 Justification of the choice of the methodology and why it is applicable to the project activity:

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The project activity fulfills the applicability criteria for the use of this methodology, as follows:

Table B.2-1 Comparison between CMM drainage activities and the applicability of ACM0008

ACM0008 Applicability	This project drainage activities
Surface drainage wells to capture CBM associated with mining activities	Not included
Operate in open cast mines	Not included
Underground boreholes in the mine to capture pre-mining activities	Included
Surface goaf wells, underground boreholes, gas drainage galleries or other goaf gas capture techniques, including gas from sealed areas, to capture post mining CMM.	Underground boreholes, gas drainage galleries to capture post mining CMM.
Ventilation air methane that would normally be vented.	Not included

Table B.2-2 Comparison of this project with ACM0008 regarding CMM utilization activities

Applicability of ACM0008	This project CMM utilization activities
The methane is captured and destroyed through	No methane is destroyed through flameless

flameless oxidation,	oxidation
The methane is captured and destroyed through flaring	No flaring of methane is involved
The methane is captured and destroyed through utilization to produce electricity, motive power, and/or thermal energy; emission reductions may or may not be claimed for displacing or avoiding energy from other sources.	The captured methane is used to generate electricity, which will displace the power from the North China Power Grid. The emission reductions will be claimed. The mine owner has provided gas drainage records for Yuecheng Coal Mine for the years 2009, 2010 and 2011. Based on this data, it can be demonstrated that no displacement of thermal demand will occur (see the explanation included beneath this table).
The remaining share of the methane, to be diluted for safety reason, may still be vented.	The remaining share of the methane, to be diluted for safety reasons, may still be vented (VAM)
All CBM and CMM captured in this project must be utilized or flared, and cannot be vented.	CMM captured by this project will be utilized for power generation.

Explanation of future Thermal Demand:
The table below has been created using the data contained in the '*Gas drainage record 2009'*, '*Gas drainage and usage record of Yuecheng in 2010'* and '*Gas drainage record 2011*' all of which were issued by the Coal Mine owner. To be ultimately conservative, and demonstrate the worst-case scenario, the hypothetical model below for thermal demand in the crediting period has been constructed:

Year	Total CH_4 extracted from the Yuecheng Coal Mine	Amount used by other mines in the Jincheng Coal mine group	Amount used by the boilers at the Yuecheng Coal Mine	Amount used by local residences	Amount used by the Proposed Project	Total Methane Used	Remaining Methane
2009	6,814.82	0	268	0	0	268	96.06%
2010	8,364.93	2,533	380.45	384.63	0	3,298.29	60.06%
2011	8,373.69	1,540.78	372.6	378.54	0	2,291.92	72.63%
CP Year 1	8,369	1,630	408	305	3,769	6,112	26.97%
CP Year 2	8,369	1,731	433	307	3,769	6,240	25.45%
CP Year 3	8,369	1,839	460	308	3,769	6,376	23.82%
CP Year 4	8,369	1,953	489	310	3,769	6,520	22.09%
CP Year 5	8,369	2,074	519	312	3,769	6,673	20.26%
CP Year 6	8,369	2,203	551	313	3,769	6,836	18.32%
CP Year 7	8,369	2,340	586	315	3,769	7,009	16.26%
CP Year 8	8,369	2,485	622	316	3,769	7,192	14.06%
CP Year 9	8,369	2,639	661	318	3,769	7,387	11.74%
CP Year 10	8,369	2,803	702	320	3,769	7,593	9.27%

* All figures here are for pure methane (thus CMM usage by project activity has been revised by methane content) and are given in 10,000m^3

The forecasts for usage in the crediting period have been made on the basis of the average of recorded data and application of relevant uplift factors. Population usage has been assumed to increase by the regional

population growth, 0.53%[3], and the usage by Yuecheng coal mine and other coalmines is increased by the average annual increase in coal production in China (2000-2009) of 6.21%[4].

As the '*Gas supply agreement'* (signed in December 2009) stipulates, there is a significant financial penalty to the coalmine for failing to deliver the demanded volume of CMM to the proposed project. Additionally, the coalmine is forbidden from entering other CMM supply agreements without approval from the PP.

Furthermore, the mine owner has confirmed[5] that it was only due to ongoing construction of the proposed project during 2010 that the excess CMM was to fulfill the thermal demand and supply obligations to residents of other coalmines. These coalmines only had use for the CMM due to unscheduled maintenance events, capacity expansions and delayed commissioning that resulted in reduced (or no) CMM being extracted from the mines. Therefore, this is an incidental and usage does not represent a stable form of demand, is not an obligation of the mine owner and holds no commercial value.

ACM0008 does not apply to project activities with the following features. The project activity does not involve any of these features.

Table B.2-3 Comparison between the project activity and the inapplicability of ACM0008

Inapplicability of ACM0008	The project activity
Capture methane from abandoned/decommissioned coalmine,	Gas capture activity is progressing simultaneously with mining activity.
Capture/use of virgin coal-bed methane	All the methane captured/used in the project is dependent with the mining activity. CBM is not involved in this project.
Use CO_2 or any other fluid/gas to enhance CBM drainage before mining takes place.	There are no CBM extraction activities at Yuecheng Coal Mine.

As stated above, this project activity meets all of the applicable conditions of ACM0008. Therefore, ACM0008 can be used for the project activity.

Since electricity generated from the project will displace electricity from the North China Power Grid (NCPG), according to ACM0008 (version 7), the emission factor of the NCPG will be calculated according to the latest version of the 'Tool to calculate of emission factor for an electricity system'.

The latest version of the "Tool for the demonstration and assessment of additionality" is used to demonstrate the additionality of the project.

[3] '*Jingcheng Population growth'* issued by the Taihang Daily on 16th May 2011.

[4] U.S. Energy Information Administration and dated 30th June 2010, available at http://www.eia.gov/countries/country-data.cfm?fips=CH#coa

[5] '*Incidental CMM usage statement*' issued by the Jincheng Coalmine Group regarding the supply of CMM to other coalmines in 2010/11.

B.3. Description of the sources and gases included in the project boundary

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As per ACM008, the spatial extent of the project boundary comprises:

- All equipment installed and used as part of the project activity for the extraction, compression, and storage of CMM and CBM at the project site, and transport to an off-site user[6];
- Flaring, flameless oxidation, captive power and heat generation facilities installed and used as part of the project activity;
- Power plants connected to the electricity grid, where the project activity exports power to the grid, as per the definition of project electricity system and connected electricity system given in "Tool to calculate the emission factor for an electricity system".

Therefore, the boundary of this project includes all of the equipment involved in the extraction of the CMM and instruments installed in the system from gas inlet of the CMM pretreatment to power output of the power station, as well as all of the power plants that are connected to the North China Power Grid. The area covered by the North China Power Grid includes Beijing, Tianjin, Hebei, Shanxi, Shandong Province and the Inner Mongolia Autonomous Region. Figure B.3-1 shows the boundary of this project.

All equipment installed as a result of the project activity is shaded in blue in the diagram of the project boundary on the following page. Yuecheng Coal Mine was in operation prior to the implementation of the project activity and CMM extraction equipment was required as per item 136 the "*National coalmine safety regulation (version 2010)*". Therefore, the existing extraction equipment is included in the project boundary (as it is used by the proposed project); however, it is not included in the financial analysis of the project. This is conservative, as the construction of extraction equipment would increase project investment.

Existing extraction equipment includes:

- Underground boreholes and gas drainage galleries used to capture and extract CMM utilising:
  - Water drainage equipment (to separate water during drilling)
  - Extraction pump and flow meter
  - Explosion-proofing
  - Transmission pipe to vent
  - Fire-proof equipment

Equipment installed for the project activity includes:

- Linkage pipeline from transmission pipe to gas pre-treatment equipment
- Pre-treatment equipment (dust and water filters for extracted gas) and compression equipment for gas
- Gas Generators
- Exhaust system
- Transformer and Grid substation

The diagram of the project boundary is given on the following page in Figure B.3-1.

[6] If these equipment existed in the baseline the project participant shall include them and explain the effect of this inclusion in the investment analysis of the project activity and in the baseline calculations.

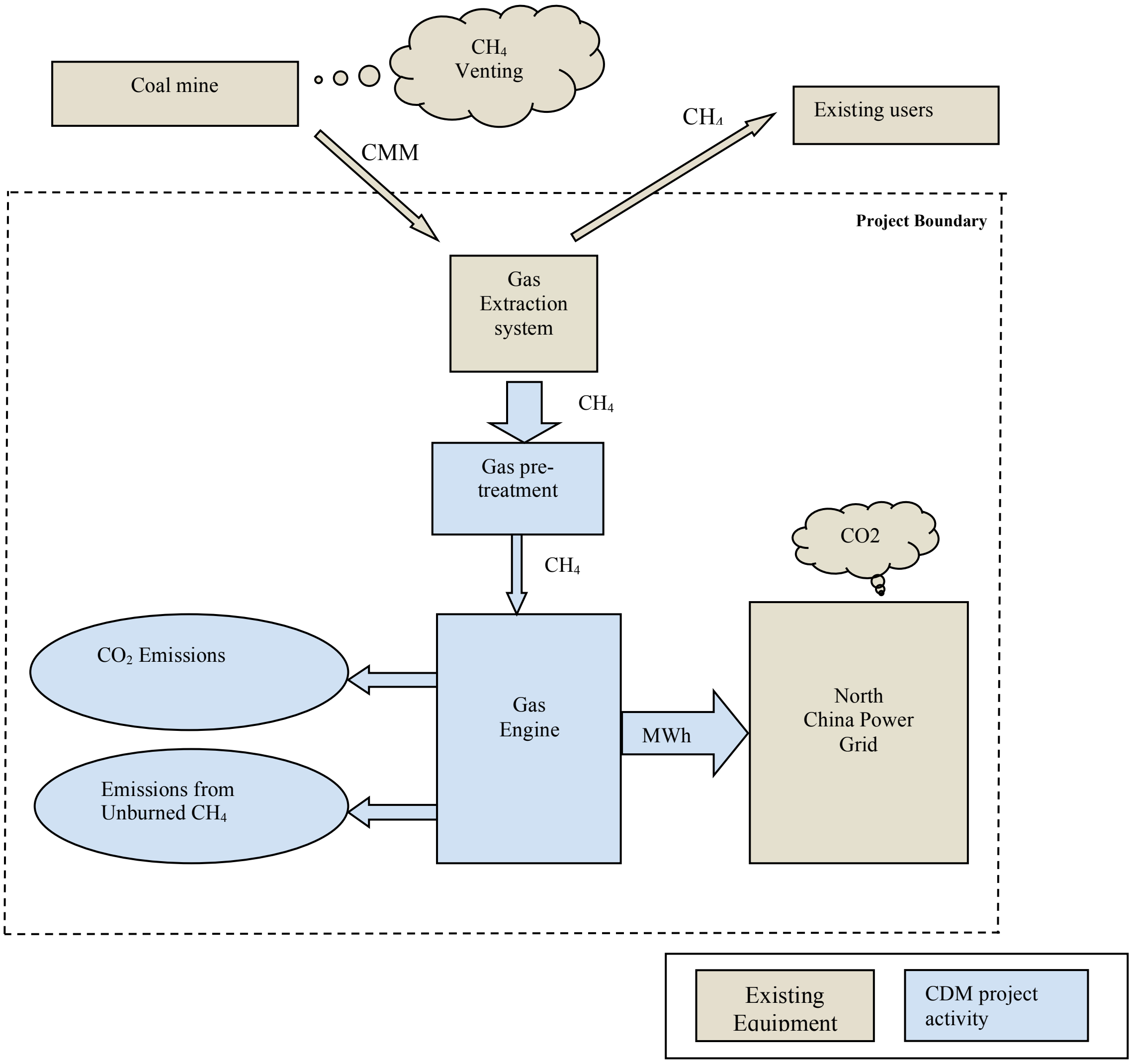

Figure B.3-1 Diagram of project boundary

The proposed project also supplies the waste heat from CMM power generation to nearby residents free of charge as an act of goodwill. This is considered to be outside of the project boundary for the following reasons:

- The static investment required to construct the WHR facility has not been included in the project static investment
- No income will be generated by the project participant from supplying the waste heat
- The emissions reductions from the displacement of the electric or gas heating used otherwise are not included in this projects CDM consideration and no CER's will be generated.

Therefore, the costs of supplying waste heat to nearby residences will be excluded from the project boundary. This is a conservative approach to the project valuation.

Types of GHG that is included within the project boundary are shown in following table:

Table B.3-1: GHG included within the project boundary

	Emission Source	Gas	Included or not?	Justification / Explanation
Baseline	Emissions of methane as a result of venting	CH_4	Included	Main emission source.
	Emissions from destruction of methane in the baseline	CO_2	Excluded	There is no methane destruction in the baseline
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Grid electricity generation (electricity provided to the grid)	CO_2	Included	Main emission source
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Captive power and/or heat, and vehicle fuel use	CO_2	Excluded	No such usage in baseline scenario.
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
Project activity	Emissions of methane as a result of continued venting	CH_4	Excluded	Only the change in CMM emissions release will be taken into account, by monitoring the methane used or destroyed by the project activity.
	On-site fuel consumption due to the project activity, including transport of the gas	CO_2	Included	Additional equipment such as compressors are accounting for this source of emission.
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.
	Emissions from methane destruction	CO_2	Included	From the combustion of methane in power generation.
	Emissions from NMHC destruction	CO_2	Excluded	In this project, NMHC accounts for less than 1% by volume of extracted coal mine gas.
	Fugitive emissions of unburned methane	CH_4	Included	Small amounts of methane will remain unburned in heat/power generation. Default emission factors are applied as per ACM0008.
	Fugitive methane emissions from on-	CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very

	site equipment			small.
	Fugitive methane emissions from gas supply pipeline or in relation to use in vehicles	CH_4	Excluded	Excluded for simplification. However taken into account among other potential leakage effects (see leakage section)
	Accidental methane release	CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

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Step 1: Identify technically feasible options for capturing and/or using CMM

Step 1a: Options for CMM extraction

As per ACM0008 the technically feasible options for CMM extraction at Yuecheng coal mine include:

Option A. Pre mining CMM extraction;
Option B. Post mining CMM extraction;
Option C. Possible combinations of A, and B, with the CDM project activity not implemented as a CDM project.

Currently there is no CBM extraction adopted at the Yuecheng coal mine. Subject to the methane concentration of VAM, utilising VAM is a feasible option, however, the methane concentration of the VAM is very low, thus there is no plan to utilise VAM. Therefore, CBM and VAM options are not dealt with in the project activities, as only CMM will be utilised for electricity generation. The Yuecheng coalmine will use same extraction system, according to the methodology ACM0008 (version 07 EB55 CMM) allowing pre-mining and post-mining CMM to be measured together, meaning the relative measurement of gas from each source in the baseline is not necessary.

Step 1b: Options for extracted CMM treatment

The possible options that are technically feasible to use CMM at Yuecheng coal mine include:

i. Venting;
ii. Using/destroying ventilation air methane rather than venting it;
iii. Flaring of CMM;
iv. Use for additional grid power generation; This option is the CDM project activity not implemented as a CDM project;
v. Use for additional captive power generation;
vi. Use for additional heat generation;
vii. Feeding into gas pipelines (to be used as fuel for vehicles or heat/power generation);
viii. Possible combinations of options i to vii with the relative shares of gas treated under each option specified.

Option i.

This is the business as usual scenario and therefore is entirely feasible

Option ii.

Although CDM projects utilizing VAM have been registered, the technology is still considered immature and the current projects have been undertaken only as pilot or demonstration projects[7]. Research into the industry found that the experience with these technologies at ongoing Chinese coal mine operations was very limited. Existing projects in China – all of which are conducted under the CDM – are still at the demonstration stage[8]. In addition, the considerable investment required would not be covered by any income from its operation. At present, the investors of the proposed project will not face the risk of unstable operation or insufficient financial return. Hence this option - Utilization of VAM – faces technological barriers due to prevailing practice.

Using VAM rather than venting it is not a technically feasible option, thus Option ii should be eliminated

Option iii.
Flaring of CMM is technically feasible option

Option iv.
Use for additional grid power generation without CDM assistance is a technically feasible option and will be discussed later.

Option v.
Use for additional captive power generation is technically feasible option and will be discussed later.

Option vi.
Currently, there are coal-boilers and gas-boilers at the Yuecheng coal mine that supply hot water for bathing of workers and heating during winter. Therefore, heat demand is fully satisfied by existing facilities at the Yuecheng coalmine. Additionally, while the mine supplies some CMM to other villages or industry in the immediate area, even this aggregated demand an extremely small amount of heating. Note that the PO is a separate entity to the coalmine and is not involved in either of these additional uses for extracted CMM.

According to the CMM drainage and utilization analysis and the "Yuecheng coalmine present gas usage in 2010", the amount of CH_4 used by boilers in the Yuecheng coal mine and local residents only made up 9.15%[9] of total CMM extracted.

Table B.4-1: Yuecheng Coalmine Present gas usage (pure CH_4) in 2010 (all units are 10,000 m^3)

Month	CH_4 extracted from the Yuecheng Coal Mine	Amount used by other mines in the Jincheng Coal mine group	Amount used by the boilers at the Yuecheng Coal Mine	Amount used by local residences
Jan	655.27	184.31	48.9	36.02
Feb	716.44	183.5	47.5	35.2
Mar	582.95	202.19	50	43.03
Apr	703.73	227.73	20.3	32.4
May	664.84	256.82	21	30.04

[7] http://www.chinanews.com/ny/2010/07-02/2377307.shtml; http://content.caixun.com/NE/01/83/NE0183ht.shtm

[8] There is one registered VAM utilization CDM project in China that is known to the project participants. So far there has been no issuance of CERs from the use of this technology.

[9] '*Gas drainage and usage record of Yuecheng in 2010*', issued by Qinxiu Coal industry Company (owner of Yuecheng Coalmine) monthly over the year 2010.

Jun	677.96	215.29	20	32.7
Jul	732.26	205.2	21	30.04
Aug	742.68	207.08	20	30.54
Sep	706.05	222.86	20	22
Oct	703.31	210.66	20	19.99
Nov	735.81	207.62	45	37.67
Dec	743.63	209.95	46.75	35
Total	8,364.93	2,533.21	380.45	384.63
% of Total	100%	30.28%	4.55%	4.60%

Data source: *"Gas drainage and usage record of Yuecheng in 2010*". Amounts given in the table are the amounts of pure CH_4.

Therefore, it is impossible to consume all drained CMM for heat generation, as there is insufficient demand for the project. As a result the use of CMM for additional heat generation is not technically feasible and should be eliminated.

Option vii.
Feeding into gas pipelines (to be used as fuel for vehicles or heat/power generation) is technically feasible option and will be discussed later.

Option viii.
Possible combinations of options i to vii with the relative shares of gas treated under each option specified is technically feasible option and will be discussed later.

Both the proposed project and the coalmine are new projects currently under construction. As such, the relative shares of each gas in the baseline will be monitored after the construction of coalmine is completed.

Step 1c: Options for energy production

Technically feasible options for power generation at Yuecheng coal mine include:
P1. Keeping on purchasing equivalent quantity of electricity from the North China Power Grid;
P2. Construction of a coal-fired captive power plant with equivalent installed capacity (20MW);
P3. CMM power generation, this is the project activity not implemented as a CDM project.

Step 1d: Options for thermal energy production:

T1. Continuation of existing situation - coal and gas fired boilers for thermal energy; and
T2. Waste heat recovery from power plant.

Step 2: Eliminate baseline options that do not comply with legal or regulatory requirements

The "*National coalmine safety regulation (version 2010)*" issued by the State Administration of Work Safety sets the conditions and requirements on coal mine safety on articles 101, 136, 145, 146 and 190. Furthermore, the Standing Committee of the National People's Congress, State Council and State Administration of Work Safety has issued a series of regulations regarding coalmine safety which can be found on the website (http://www.chinasafety.gov.cn).

At present, methane control requirements in these laws and regulations are only for health and safety purpose. Each coalmine is obliged to extract a certain amount of CMM prior to their coal mining activities

but there exists no mandatory requirements on the utilization of the extracted gas. The CMM extraction, treatment and energy generation scenarios that do not comply with legal and regulatory requirements will be eliminated one by one below.

Step 2a. Options for CMM extraction

Item 136 the "*National coalmine safety regulation (version 2010)*" in particular, specifies that methane concentrations in the mine air should be below 1% in order to negate the risk of explosion. However, a concentration of this level would be unachievable at the Yuecheng Coalmine solely through the use of ventilation. Furthermore, Item 145 specifies that an above ground gas drainage station be constructed above ground when the CMM emission rate of a mine exceeds 40m^3/min. According to the FSR (section 1.2.3, p.6), average CMM gas emission rate of Yuecheng Coalmine is 456 m^3/min.

It can be seen that this CMM emission rate far exceeds the threshold of 40m^3/min specified in Item 145 of the "*National coalmine safety regulation (version 2010)*". Therefore the project activity requires gas to be extracted through the use of underground boreholes. As a result, the relative shares of pre-mining and post mining CMM are difficult to quantify, as they will both be bought to the surface through the same extraction system.

With consideration given to these legal and regulatory requirements, Options A and Bin *Step 1a: Options for CMM extraction* can be eliminated. Option C, a combination of pre and post mining CMM extraction will be used.

With consideration given to these legal and regulatory requirements, Options A and B in *Step 1a: Options for CMM extraction* can be eliminated. Option C, a combination of pre and post mining CMM extraction will be used as it remains the only option that is technically feasible and in compliance with national legal or regulatory requirements.

Step 2b. Options for extracted CMM treatment

For CMM utilization, it is regulated that if methane concentration is lower than 30%[10], gas utilization and transportation must be in accordance with the relevant standards and the related safety technology measures need to be considered. At the Yuecheng coalmine, the average methane content of extracted CMM is 35%[11]. Therefore, as the methane extracted from Yuecheng coalmine exceeds the range for which legal and regulatory requirements are imposed, the transport and utilization of extracted CMM in the project activity is compliant with all applicable safety laws.

While the Chinese government promotes the utilization of CMM, in June 2005 the NDRC announced the Coalmine Methane Treatment and Utilization Macro Plan to encourage CMM drainage and utilization, calling for the incentives from CDM to overcome barriers in the country to implement CMM drainage and utilization activities.

The following discourse discusses the implications of regulatory requirements on the potential baseline options for the use of extracted CMM not previously ruled out.

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[10] *National Coalmine Safety Regulation 2010* - Item 148, issued by the Environment Protection Bureau/National Quality Inspection Checking Bureau. Available at http://www.chinacoal-safety.gov.cn/Contents/Channel_5351 /2010/0126/83596/content_83596.htm

[11] CMM component analysis report" issued by Jincheng City Gas Testing centre on 23 Dec 2009 (this report was made according to the GB/T13610-2003 standard).

Option i. - Venting;
The treatment of extracted CMM is generally subject to the "Emission Standard of Coal Bed Methane/Coal Mine Methane (GB 21522-2008)[12]" that was issued by the Chinese Ministry of Environment Protection on 2nd April 2008. This provision, effective as of 1st July 2008, states that for existing coal mines, direct CMM venting is prohibited from 1st July 2010 in cases where the methane concentration of CMM is above 30%. According to ACM0008 (version 05), if it is demonstrated that such regulations are systematically not enforced and that non-compliance with those requirements is widespread in the country or region, the relevant alternative (i.e. venting) does not need to be excluded from further consideration. It is the responsibility of the regional government's Environmental Protection Agencies to mandate this standard, however research on current practices with regard to the Emission Standard proved that neither widespread implementation nor any measures to supervise compliance exist. Thus, the above-mentioned regulation is not considered in the identification and elimination of possible baseline scenarios and venting remains in compliance with all applicable regulatory and legal requirements.

According to ACM008 version 7, if "based on an examination of current practice in the country or region in which the laws or regulation applies, those applicable legal or regulatory requirement are systematically not enforced and that non-compliance with those requirements is widespread in the country", then it need not be considered in the baseline selection analysis. The Emission Standard of CBM/CMM (on trial) GB21522-2008 states that from 1 January 2010, it will be forbidden to vent CMM with a concentration of >30%. This standard is not considered in the baseline analysis because:

1. Questions remain about implementation and subsequent enforcement of the Standard

The Standard itself is a high-level document giving only outline details of the content and its applicability. It refers to three further regulations for details of implementation and enforcement. These regulations are listed in table B.1 below, together with details of key components of them.

Table B.1: Regulations referred to in the Standard and key components of these regulations

Regulation	Key, relevant components
Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution[13]	Article 11. New construction projects, expansion or reconstruction projects which discharge atmospheric pollutants shall be governed by the State regulations concerning environmental protection for such projects. An environmental impact statement on construction projects shall include an assessment of the atmospheric pollution the project is likely to produce and its impact on the ecosystem; stipulate the preventive and curative measures. The statement shall be submitted, according to the specified procedure, to the administrative department of environmental protection concerned for examination and approval. When a construction project is to be put into operation or to use, its facilities for the prevention of atmospheric pollution must be checked and accepted by the administrative department of environmental protection. Construction

[12] http://www.ep.net.cn/ut/bz/2008/gb21522.pdf

[13] *Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution* (Adopted at the Fifteenth Meeting of Standing Committee of the Ninth National People's Congress on April 29, 2000; promulgated by the President of the People's Republic of China on the same date, effective as of September 1, 2000.) http://english.mep.gov.cn/Policies_Regulations/laws/environmental_laws/200710/t20071009_109943.htm

	projects that do not fulfil the requirements specified in the State regulations concerning environmental protection for such construction projects shall not be permitted to begin operation or to use. Article 13. Where atmospheric pollutants are discharged, the concentration of the said pollutants may not exceed the standards prescribed by the State and local authorities. Article 48. Whoever, in violation of the provisions of this Law, discharges pollutants to the atmosphere in excess of the national or local discharge standards shall make treatment thereof within a time limit, and shall also be imposed upon a fine of not less than 10,000 yuan but not more than 100,000 yuan by the administrative department of environmental protection under the local people's government at or above the county level. The power to decide on the treatment within a time limit and the administrative penalty for violation of the requirements for treatment within a time limit shall be prescribed by the State Council.
Measures for the Administration of Automatic Monitoring of Pollution Sources[14]	Article 2. The present Measures shall be applicable to the supervision and administration of the automatic monitoring system for the key sources of pollution. The present Measures shall be followed in the construction, management and operation maintenance of the automatic monitoring system for the discharge of water pollutants, air pollutants and noise at the key sources of pollution. Article 5. The State Environmental Protection Administration shall be responsible for guiding the work of automatic monitoring on key pollution sources countrywide, and formulate relevant work systems and technical specifications. The local environmental protection departments shall, on the basis of the requirements of the State Environmental Protection Administration, and in light of the principle of overall planning, … determine the key pollution sources that shall be subject to automatic monitoring, and formulate work plans. Article 11. The automatic monitoring equipments and their supporting facilities for any newly built, restructured or expanded technological reformation project shall be built and installed according to the approved documents of environmental impact assessment, and shall be designed, constructed and put into use simultaneously with that of the principal part of the project as a component part of the environmental protection facilities. Article 13. The expenses for the construction, operation and maintenance of the automatic monitoring equipments shall be collected by the pollutant-discharging entities themselves, and the environmental protection departments may grant subsidies thereto; as to the expenses for the operation

[14] SEPA order no. 28, *Measures for the Administration of Automatic Monitoring of Pollution Sources*, published by National Environmental Protection Bureau on 1st Nov 2005 and available at http://www.nnhb.gov.cn/uploadfile/2008314153359411.pdf (Chinese) and http://faolex.fao.org/docs/texts/chn61891.doc (English)

	and maintenance of the monitoring centers, the environmental protection departments shall make budgets and apply for funds for that purpose. Article 16. In case any existing pollutant-discharging entity violates the provisions of the present Measures, and does not complete the installation of any automatic monitoring equipment and its supporting facilities within the prescribed time limit, the environmental protection department at or above the county level shall order it to correct within a prescribed time limit, and impose upon it a fine of less than RMB 10,000 Yuan. Article 17. In case any entity violates the provisions of the present Measures, and officially puts into production or use the principal part of a newly built, restructured, expanded or technologically reformed project without installing the automatic monitoring equipment and its supporting facilities on such project, or without having the project checked and accepted or without passing the checking of the project, the environmental protection department that makes examination and approval on the documents of environmental impact assessment on the construction project shall, in accordance with the Regulation on the Administration of Environmental Protection on Construction Projects, order it to stop the production or use of the principal part of the project, and may impose upon it a fine of less than RMB 100,000 Yuan
Measures for the Administration of Environmental Surveillance[15]	Article 3. The environmental surveillance shall be a statutory responsibility of an environmental protection authority at or above the county level. An environmental protection authority at or above the county level shall build an advanced environmental surveillance system according to the requirements for accurate data, strong representativeness, scientific methods and timely transmission, so as to provide a policy basis for such environmental administrative work as fully reflecting the environmental quality and trend of changes, timely tracing the changes of pollution sources and accurately warning of various environmental emergencies.

In addition to this, the provincial Environmental Protection Bureau in Shanxi Province (where the proposed project is located) issued further guidance[16] on measures to monitor the discharge of pollutants, re-iterating many of the clauses detailed in table B.1 above.

The regulations listed in table B.1 above broadly outline the requirements for compliance and potential penalties for coal mine operators as well as requirements for local Environmental Protection Bureaus (EPB) to monitor compliance. However, these regulations are broad in their scope, covering everything from spills of pollutants into rivers to monitoring of emissions of air pollutants from power stations. They do not contain any specific guidance for monitoring the concentration of vented CMM and, as such significant

[15] SEPA order no. 39, *Measures for the Administration of Environmental Surveillance*, published by National environmental protection bureau on 25th July 2007 and available at http://www.zhb.gov.cn/info/gw/juling/200708/t20070807_107652.htm (Chinese) and http://faolex.fao.org/docs/texts/chn73543E.doc (English)

[16] For example, the "*Measures for Award and Punishment of Shanxi Province Key Entities with High Pollutant to Construct Automatic Monitoring System*", Jinhuanfa No.521(2007) http://www.sxhb.gov.cn/news.do?action=info&id=7847

issues and questions around enforcement and monitoring of compliance with the Standard in practice remain. For example:

- The Standard, in common with other environmental legislation in China, was issued by the Ministry of Environmental Protection (MEP) in Beijing. According to the Standard, implementation will lie with local, county level EPB. However, to date, Yuecheng coalmine has obtained the "Permission of discharging of pollution and emission " from the Shanxi Province Environmental protection Bureau[17].

  As identified by the Economics Institute of Shanxi Academy of Social Sciences[18]:

  "It is difficult for incentive policies from state government to be realized in local level. For example, State EPB issued the …Emission Standard of CBM/CMM (on trial) GB21522-2008… However, the related guidance on implementation of the standard for both entity and local EPB has not been issued i.e. the monitoring system for the entity and the administration system of the government including the requirements for monitoring equipment and human resources, budgetary, training system have not been detailed."

  In Shanxi province, there are a total of 1053 coal mines[19], many of which are located in remote, rural areas. It is therefore costly and time-consuming for local EPB to establish the monitoring system for coal mines in the first place and subsequently to inspect the compliance by local coal mines.

- Article 5 of the Standard states that automatic monitoring equipment should be installed at coal mines to monitor the concentration of vented CMM and should be connected to a central monitoring system at the local EPB. However, as explained above, no further guidance has been given by the Chinese government about how local EPB should set up these central monitoring systems or how the costs of this should be covered[20].

- Further, except for the general guidance detailed in table B.1, no guidance has been given to local EPB as to how assess compliance (or not) with the Standard. For example, an average should be calculated to determine if, over the course of the year, concentration is above or below 30%. Coal mine gas is a variable resource, both in quality and in quantity (i.e. concentration of methane)[21]. CMM quantities and quality are determined by a complex range of inter-related factors, most notably by the rate of coal extraction; the gas concentrations in the working coal face and in the surrounding seams; and by the gas drainage techniques employed. This means that the volume and concentration of gas extracted will fluctuate significantly according to factors outside the control of the coal mine owner and power plant operator. Without guidance to demonstrate how an average concentration is calculated, it will not be possible for local EPB to determine compliance or not.

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[17] "Permission of discharging of pollution and emission" issued by Shanxi Province Environmental Protection Bureau on 30th Dec 2011

[18] Economics Institute of Shanxi Academy of Social Sciences, *Measures and Suggestions on Encouraging the Development of the CMM and Natural Gas Industry in Shanxi Province (2010 to 2020)*, October 2010

[19] http://energy.nmgnews.com.cn/system/2010/06/02/010445188.shtml

[20] Economics Institute of Shanxi Academy of Social Sciences, *Measures and Suggestions to Encourage the Development of the CMM and Natural Gas Industry in Shanxi Province*, October 2010

[21] UN Economic Commission for Europe, Ad Hoc Group of Experts on Coal Mine Methane.

Response to Misconceptions about Coal Mine Methane Projects (Para. 9) (available at http://www.unece.org/energy/se/pdfs/cmm/AHGE_Letter_Misconceptions_CMM.pdf).

- The Standard requires that coal mine operators monitor and record emissions of CMM on-line[22]. However, to date coal mine owners have not received any training or guidance from local or central government on how to connect their own monitoring systems with that of the local government so that local EPB can collect emissions data on line and assess implementation of the Standard.

- Article 5.2 of the Standard states that automatic monitoring systems should be installed in new coal mines. However, there is no such provision requiring this for existing coal mines (who are expected though to comply with the Standard). Clearly without specific requirements to do this, it is unlikely that many existing coal mines will voluntarily go to the expense and trouble of installing such a system. In this case, the local EPB will be unable to systematically enforce compliance.

2. Gas utilisation and drainage data for Shanxi Province show that the majority of high concentration CMM will still be vented

Targets for CMM drainage and utilisation were set in the Twelfth Five Year plan (2011-2015)[23]:

- The drainage amount of CMM will reach 14 billion cubic meters by 2015
- The utilisation amount of CMM will reach 8.4 billion cubic meters by 2015 (i.e. a utilisation rate of 60%)

A year on year improvement has been seen since then, as shown in figure B.2 below, and the 2010 drainage target was hit and surpassed earlier than expected. Improvements in drainage stemmed from governments concerns over mine safety and additional funding that was made available for new drainage systems and the enhancement of existing systems[24]. Utilisation however remains relatively stable at around 30% of gas drained and the 2010 target is therefore unlikely to be hit.

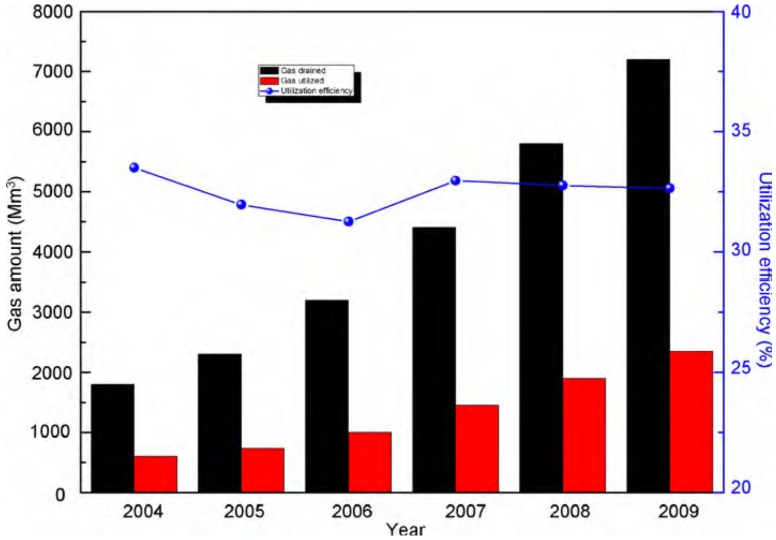
Figure B.2: CMM drainage and usage in China, 2004-09[25]

[22] E.g. the drainage record made by the Yuecheng coalmine in December of 2009,2010 and 2011

[23] State Council of the P.R. of China, *12th Five-Year Plan for Development and Utilization of Coalbed Methane and Coal Mine Methane (2011-2015) published China NDRC on 26 Nov 2011* (available at http://www.sdpc.gov.cn/zcfb/zcfbtz/2011tz/t20111231_454225.htm).

[24] Energy Sector Management Assistance Program (the World Bank Group), *A Strategy for Coal Bed Methane (CBM) and Coal Mine Methane (CMM) Development and Utilization in China*, 2007 (available at http://web.worldbank.org/external/projects/main?pagePK=64256111&piPK=64256112&theSitePK=40941&menuPK=115635&entityID=000020953_20070828093241&siteName=PROJECTS)

[25] Cheng, Y-P et al, *Environmental Impact of coal mine methane emissions and responding strategies in China, International Journal of Greenhouse Gas Control*, 2010 (Article in press).



The latest data shows that:

In 2010, the total drainage volume of CMM gas is 7.35 billion cubic meters and the total used amount is 2.5 billion cubic[26];

in 2011, the total drainage volume of CMM gas is 9.2 billion cubic meters and the total used amount is 3.2 billion cubic meters[27].

There are 1053 coal mines in Shanxi Province[28], where the proposed project is located, and CMM drained in this province makes up over 1/3 of the total CMM drained in China[29]. Determination of the number of coal mines abiding by the regulation is not possible due to::

(i) As explained above, CMM is a variable resource both in quantity and quality (i.e. methane content). In the absence of detailed, technical guidance on how to calculate an average concentration over a period of time, it is not possible to ascertain which mines drain CMM with a methane conc. >30% and which do not.

(ii) One coal mine may have a number of drainage stations and it is possible that at one drainage station CMM is utilised and at another it is not i.e. partial compliance with the Standard could be possible.

However, data has been released by the State and Provincial governments of Shanxi on the volumes of CMM with a high concentration[30] of methane drained and utilised in Shanxi Province over the past few years (see table B.2 below). This can be used to give an indication of anticipated levels of compliance with the Standard.

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[26] News “CMM gas extraction volum” published by China Energy Paper on 10th Jan 2011, available at http://paper.people.com.cn/zgnyb/html/2011-01/10/content_719599.htm

[27] News “CMM gas extraction in 2011” published by China Economy Net on 17th Jan 2012, available at: http://www.ce.cn/cysc/ny/meitan/201201/17/t20120117_21102500.shtml

[28] News “Merging time of coalmines in Shanxi “published by China Wealth Net on 02nd Oct 2011, available at: http://energy.nmgnews.com.cn/system/2010/06/02/010445188.shtml

[29] Information “Shanxi CMM resource” published by National Energy Administration on 30th Oct 2012, available at: http://www.nea.gov.cn/2012-10/30/c_131940177.htm

[30] No exact definition of ‘high concentration’ is given but it is commonly understood that this is CMM where the methane content is generally >25-30%.

Table B.2: CMM with a high concentration of methane drainage and usage in Shanxi province[31]

	Unit	2006	2007	2008	2009	2010	2011
Drainage	Billion m^3	1.611	2.080	2.160	2.250	2.513	2.674
Utilization	Billion m^3	0.327	0.558	0.767	0.873	1.01	1.135
% Utilisation	%	20.30	26.83	35.51	38.8	40.2	42.45

NB. The data above includes utilisation of CMM by CDM projects

This clearly shows that the majority of CMM with a high concentration of methane was vented prior to the Standard being published and implemented. This was still the situation following publication of the Standard in 2008 and subsequent implementation. Despite year-on-year improvement in utilisation of CMM with a high concentration of methane, in 2010 and 2011, there was slight increase in the utilization, however, the majority of the drained CMM gas (over 50%) was still not used.

There are a number of reasons for this:

(i) No additional funding or training has been given to coal mine operators to help them comply with the Standard. As outlined in the PDD, there are many barriers facing the utilization of CMM in China, as elsewhere in the world:

- Investment barriers: Attracting finance for CMM utilization projects can be difficult and typically projects are unattractive to investors: (i) many mines have poor credit ratings with banks and are unable to get loans to undertake projects themselves[32] (ii) Chinese enterprises have a lack of funds to invest in such projects and many schemes are too small to attract financial institutions[33]
- Purity Uncertainty: CMM production is linked to mining production and therefore the purity or flowrates are not under the control of the gas engine operator. This can lead to times when the gas supply is not >30% and therefore below the minimum safety threshold for use by the gas engine or other end-user. This uncertainty increases investment risks which are not compensated for in the return.
- Technological barriers: Power generation from CMM has a low market share in China and involves certain risks due to equipment performance and management uncertainty. Power generation from CMM is a new area of business for the project owner, and therefore carries higher risks.

This is further recognised by the IEA[34],

> *"Many CMM projects are not cost-effective at standard market rates for power and natural gas. Further, many coal mines do not have adequate internal investment capital for project funding"*

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[31] Economics Institute of Shanxi Academy of Social Sciences, *Special Report on CMM Drainage and Utilisation In Shanxi Province*, October 2010 and "high concentration CMM gas drainage and usage in Shanxi province" by Shanxi government Coal Industry Department 28th Nov 2012

[32] UK Department of Trade & Industry, *Enhancing Coal Mine Methane Usage in China*, December 2005 (p23-4, available at www.berr.gov.uk/files/file29223.pdf) and IEA, *Energy Sector Methane Recovery and Use*, 2009 (p21)

[33] Energy Sector Management Assistance Program (the World Bank Group), *A Strategy for Coal Bed Methane (CBM) and Coal Mine Methane (CMM) Development and Utilization in China*, 2007 (available at http://web.worldbank.org/external/projects/main?pagePK=64256111&piPK=64256112&theSitePK=40941&menuPK=115635&entityID=000020953_20070828093241&siteName=PROJECTS)

[34] IEA, *Energy Sector Methane Recovery and Use*, 2009 (p21)

In addition to this, Economics Institute of Shanxi Academy of Social Sciences identified that CMM utilisation is not core business for coal mine companies who would rather invest scarce financial resources in expanding coal production than in CMM utilization technologies[35]:

> *"To drain CMM has been deemed as a way to improve the safety of coal mines rather than as a potential resource... Therefore coal mine owners only budget for measures needed to meet national safety criteria for coal mine operation. Coal mines owners have not paid attention to the potential for CMM utilization".*

Also please note: According to the common practice of CMM power generation in Shanxi provinces, among the 54 CMM power generation projects[36] (approved before 2012) in Shanxi provinces, there are 44 projects which are registered as CDM projects or under the CDM validation process which represents 951.1 MW among the total installation capacity of 988.9 MW. The projects with CDM support holds 96.18% of the total installation capacity of CMM power generation projects in Shanxi province. Therefore, majority of such utilization is based on the CDM support. It is not conceivable that coal mine owners will be able to comply with this Standard without the CDM or additional funding from another source. Indeed, according to a statement published in July 2009, the attitude of the Chinese government is that they

> *"encourage companies to achieve the standard required by the regulation with help from the CDM. This is because the real IRR of most CMM projects (except for a few demonstration projects) is … almost negative…. With this situation, the implementation of this CMM regulation in China definitely cannot be accomplished by even 50% without CDM"*[37].

According to the data released by the State and Provincial governments of Shanxi, utilisation of CMM with high methane content can be broken down into CMM used for power, for fuel and or other uses. In the power generation, projects with CDM support holds about 96.18% of total installation capacity of all approved CMM power generation projects.

According to the common practice section of the PDD, all other CMM fired power projects in Shanxi Province are also applying for CDM finance. It can therefore be assumed that all CMM being used for similar installation power generation in Shanxi Province is being utilised because of the CDM. If these power projects are excluded from the total utilisation figures[38], utilisation of CMM with high methane content *excluding* CDM projects is less than 15%, as shown below.

Table B.3: Breakdown of CMM utilisation in Shanxi Province

	Total drained	Total utilisation	Total utilisation (exc. Power)	% utilisation exc. Power	Power	Fuel	Other
2006	1.611	0.327	0.187	11.61	0.14	0.12	0.067

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[35] Economics Institute of Shanxi Academy of Social Sciences, *Special report: CMM Drainage and Utilization in Shanxi Province(2010 to 2020)*, October 2010

[36] CPA of CMM power generation projects in Shanxi Province

[37] Article "CDM evolution" published by China CDM governmental website on 16 July 2009 , available at: http://cdm.ccchina.gov.cn/web/NewsInfo.asp?NewsId=3719

[38] This is conservative as other registered CDM projects also use some CMM for fuel (e.g. registered project 902) and for other uses, and this volume of CMM is not excluded here.

2007	2.08	0.558	0.358	17.21	0.2	0.27	0.088
2008	2.16	0.767	0.367	16.99	0.4	0.27	0.097
2009	2.25	0.873	0.323	14.36	0.55	0.28	0.043
2010	2.513	1.01	0.36	14.33	0.65	0.3	0.06
2011	2.674	1.135	0.365	13.65	0.77	0.3	0.065

(ii) The likely fine for non-compliance with the regulation will not be sufficient to incentivise coal mine owners to comply

Table 1 above shows that, according to the Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution, article 48 *“Whoever…discharges pollutants to the atmosphere in excess of the national or local discharge standards shall make treatment thereof within a time limit, and shall also be imposed upon a fine of not less than 10,000 yuan but not more than 100,000 yuan by the administrative department of environmental protection under the local people's government at or above the county level”.*

If the Standard was fully implemented and enforced, then coal mine operators who drain CMM with a concentration ≥30% would be faced with three choices:

i. Continue to vent CMM with a methane concentration ≥30% and pay the fine (maximum 100,000RMB pa). In this scenario no investment would be needed.
ii. Implement a project to utilise/ destroy the CMM (in the case of the proposed project this would consist of a project to install gas gen sets to utilise high concentration CMM to generate electricity which is then sold to the grid, waste heat recovery boilers to provide heat to buildings and a flare to destroy CMM when the gen sets are not in use) thereby avoiding paying the fine.
iii. Install equipment to dilute any CMM with a methane concentration ≥30% to a concentration <30% and continue to vent, thereby avoiding paying the fine. The equipment needed to be this would be simply an air inlet valve and a gas detector to regulate the proportions of air and methane. The total cost of this would depend on the exact specifications of the drainage system at a particular mine but would likely be less than 100,000RMB with an annual repair cost of 5% of the initial investment.

The NPV was calculated for each of the three scenarios above and the results presented in table 4 below (see also spreadsheet entitled “Yuecheng IRR scenarios_analysis”).

Table B.4: NPV of possible scenarios

Scenario	**NPV**
Continue to vent high concentration CMM and pay the fine (maximum 100,000RMB pa)	- 676,935
Implement a project to utilise/ destroy the CMM thereby avoiding paying the fine.	- 13,914,455
Install equipment to dilute any CMM with a concentration ≥30% to a concentration <30% and continue to vent, thereby avoiding paying the fine.	- 132,008

This shows that even if penalties for non-compliance are introduced and enforced, implementing utilisation projects such as the proposed project will still be financially unattractive. The most financially attractive option would be to install low cost equipment to dilute CMM with a high methane concentration to a methane concentration lower than 30%, thereby avoiding paying the fine.

As recognised by the World Bank[39]:

> *"A weakness of the policy is that no incentive is provided to encourage mines with poor gas drainage that are extracting methane at low and hazardous concentrations to improve performance".*

This was also recognised in a recent study by the IEA[40]:

> *"the new policy requiring methane use if CMM concentrations equal or exceed 30% appears to be creating uncertainty for CMM utilisation projects. Based on anecdotal reports gained from the interviews, this policy may result in an increase in CMM dilution to avoid the requirement of flaring/use"*

And this situation would certainly have safety implications as diluting drained CMM would likely place it in the explosive range of methane, as described earlier.

3. In common with other environmental legislation in China, the Standard is not systematically enforced by the local authorities

Looking at other environmental legislation in China, it can be seen that levels of compliance have been identified by both the Chinese government and external bodies as an issue. For example, a report for the Organisation for Economic Co-operation and Development stated that[41]:

> *"The Chinese government has identified inadequate enforcement as one of the key factors in China's deteriorating environmental situation. The 9th, 10th and 11th FYPs [five year plans] emphasised the need to strengthen environmental enforcement and compliance assurance...*

There appear to be three main reasons for this:

a. "Environmental policies have often been declarative and unrealistic". Much of this stems from a fundamental cultural difference between law-making in China and other countries. For example,

   "the abstract nature of many environmental provisions makes them seem more like 'policy statements and propositions of ideals' rather than laws. Actions are encouraged but not required, or if they are, little guidance is provided as to procedures and specific goals. For

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[39] World Bank, CCII and ESMAP, *Economically, socially and environmentally sustainable coal mining sector in China*, December 2008 (available at http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2009/01/15/000333037_20090115224330/Rendered/PDF/471310WP0CHA0E1tor0P09839401PUBLIC1.pdf)

[40] International Energy Agency, *Coal Mine Methane in China: A Budding Asset with the Potential to Bloom*, 2009

[41] Organization for Economic Co-operation and Development, *Environmental Compliance and Enforcement in China*

example, the use of the word 'should' instead of stronger terms such as 'shall' or 'must' is frequent" [42]

b. An 'implementation gap' between national law makers and local law implementers. For example, according to the OECD[43]:

"The general policy framework favouring development over the environment compromises the work of enforcement bodies at the subnational level and results in widespread non-compliance with environmental requirements"

Local EPBs are generally funded by local government rather than the central Ministry of Environmental Protection which results in pressure placed on EPB officers to ignore environmental legislation in the case of certain enterprises who exert a strong influence on local government.

c. Insufficient resources and technical capacity for local EPB to carry out their duties: "*There are simply too many enterprises to be monitored in China and too few trained personnel to carry out Inspections"*.[44]

The new Standard regarding CMM utilisation can be seen to be following a similar pattern i.e. a statement of a policy ideal, rather than a required state of affairs with strict procedures for compliance and penalties for non-compliance.

In summary, in common with much other environmental legislation in China, the Emission Standard of Coalbed Methane/Coal Mine Gas (GB 21522-2008) (on trial) can be seen as a 'policy ideal' and aspirational target. The Chinese government has not yet published comprehensive guidance on how the Standard will be implemented and how enforcement will be monitored. Local EPB have not received implementation guidelines from the MEP detailing how they should enforce the Standard and coal mine owners have also not received any guidance on implementation and enforcement of the Standard. Even if this guidance were to be issued, it has been recognised by the OECD and others that conflicting priorities and insufficient capacity at a local level are likely to impede enforcement by local EPB.

Further, as the EIA was approved prior to the implementation of the Standard, there were no requirements for provisions for automatic monitoring equipment (to monitor the concentration of vented CMM) to be installed as part of the project. This will be the case for all existing coal mines and shows that the Standard cannot be systematically enforced unless the government issues further guidance requiring all existing coal mines to install automatic monitoring equipment, which has not yet happened.

Finally, based on gas drainage and gas utilisation data for Shanxi Province for 2006-2011 it can be seen that utilisation rates of high concentration CMM were around 40%. The increase of the utilization is because more and more CMM power generation projects put into operation based on the CDM support. Even though, majority of high concentration CMM gas is still being vented.

[42] Jennifer Wu, *Public Participation in the Enforcement of China's Anti-Pollution Laws*, 4/1 Law, Environment and Development Journal (2008), p. 35

[43] Organisation for Economic Co-operation and Development, *Environmental Compliance and Enforcement in China* 2008

[44] Jennifer Wu, *Public Participation in the Enforcement of China's Anti-Pollution Laws*, 4/1 Law, Environment and Development Journal (2008), p. 35

This can be attributed to the barriers facing CMM utilisation projects in China as many coal mine operators lack the resources to be able to comply with the Standard without additional, external resources (such as the CDM).

Further, even if penalties for non-compliance were implemented and enforced, the level of the fines is unlikely to be sufficient to incentivise coal mine operators to comply with the Standard i.e. considering the NPV of the three options available to coal mine owners[45], the most financially attractive option for coal mine operators is to install low cost equipment to dilute CMM with a high concentration of methane to a methane concentration lower than 30%. This has implications for the safe operation of the CMM drainage system at these mines and also demonstrates that even if the Standard were enforced; venting would still be the baseline scenario.

For these reasons, the Standard is not considered in the baseline analysis for the Yuecheng CMM power Generation Project.

Additionally, the utilization of CMM for power generation in the project activity is feasible and in compliance with all relevant legal and regulatory requirements. Table B.4-1 shows that in 2010 existing users of CMM from the Yuecheng coalmine consumed 39.45%, or 95,770,830m^3 of CMM (adjusted for CH_4 concentration of 35%), of total CMM extracted. The FSR estimates annual CMM extraction from Yuecheng coalmine to be 239,670,000m^3 (Section 1.2.3, p.6) of which the proposed project will utilise 45.8%, or 109,710,000m^3 of CMM (35% CH_4) extracted (Section 7.7, p.51). As the extracted amount of CMM will vary slightly each year (in 2010, 238,998,000m^3 was extracted), it can be estimated that around 13-15% (33,000,000m^3) of extracted CMM will remain unutilized each year[46]. Given the investment required to construct a CMM power station it is conservative and logical to leave a buffer should extracted CMM reduce. As the generator capacity is fixed and the PP is not planning to increase the capacity for electricity generation in the future, the amount of gas extracted from the Yuecheng Coal Mine is sufficient to supply the project usage.

In summary, the reasons above confirm option i. – venting of CMM as the feasible and realistic baseline scenario. Similarly, options i, iii, iv, v, vii and viii are all technically feasible and in compliance with legal and regulatory requirements and will be further discussed below.

Step 2c. Options for Energy production

The project activity includes the construction of a 20MW CMM power generation plant for which the electricity generation is roughly equivalent to a coal-fired power plant with a capacity of approximately 20MWh[47]. According to Chinese power regulation, it is strictly prohibited to build coal-fired power plants

[45] These scenarios are (i) Continue to vent high concentration CMM and pay the fine; (ii) Implement a project to utilise/ destroy the CMM thereby avoiding paying the fine and (iii) Install equipment to dilute any CMM with a concentration $\geq$30% to a concentration <30% and continue to vent, thereby avoiding paying the fine.

[46] *'Gas drainage and usage record of Yuecheng in 2010'* issued by Qinxiu Coal industry Company (owner of Yuecheng Coalmine) monthly over the year 2010. Also refer to '*Yuecheng coalmine Present gas usage and Project gas usage explanation*' for further clarification.

[47] According to China Electric Power Yearbook (2009) p.698, the annual utilization hours of fossil fuel power plant is 5,069 hours. Thus the electricity generation of the project equals to that of a coal-fired power plant with net capacity of 103,680MWh/5069h ≈ 20.45MW

with capacities below 135MW[48]. Therefore option P2 given in *Step 1c. Options for Energy Generation* does not comply with the legal and regulatory requirements and will be eliminated.

Options P1 and P3 presented in *Step 1c. Options for Energy Generation* are both in compliance with all relevant legal and regulatory requirements of the Chinese government and remain feasible baseline scenarios.

Thermal energy production:
Scenario T1 (Continuation of existing situation - coal and gas fired boilers for thermal energy) and Scenario T2 (Waste heat recovery from power plant) both comply with all relevant legal and regulatory requirements.

Step 3: Formulate baseline scenario alternatives
The technically feasible baseline scenario alternatives that comply with all legal and regulatory requirements are identified below:

3a. Baseline scenario alternatives for CMM extraction

Scenario C
The combination of A and B, with pre mining CMM/post mining CMM.

3b. Baseline scenario alternatives for extracted CMM treatment

Scenario i: Venting;
Scenario iii: Destroyed via flaring;
Scenario iv: Use for additional grid power generation;
Scenario v: Use for captive power generation;
Scenario vii: Feed into pipeline (used by vehicles or used for power or heat generation);
Scenario viii: The combination of scenarios i and vii.

3c. Baseline scenario alternatives for energy production

Power generation:
Scenario P1: Continuation of the current situation, purchasing electricity from the North China Power Grid;
Scenario P3: Use CMM for power production, this is the project activity not implemented as a CDM project.

Thermal energy production:
Scenario T1: Continuation of existing situation - coal and gas fired boilers for thermal energy;
Scenario T2: Waste heat recovery from power plant.

Step 4: Eliminate baseline scenario alternatives that face prohibitive barriers
Barriers exist that would prevent identified baseline scenario alternatives to occur in the absence of the CDM. The baseline scenario alternatives formulated above in Step 3 will be assessed here with consideration to those barriers.

4a. Barriers analysis made on baseline alternatives for CMM extraction

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48 "Decision on strictly forbidding the illegal construction of fuel-fired power plant with the capacity 135MW and below", General Office of the State Council, http://www.gov.cn/gongbao/content/2002/content_61480.htm

Scenario C
It is the continuation of the current situation, and therefore faces no barriers.

4b. Barriers analysis made on baseline alternatives for extracted CMM treatment

Scenario i - Venting
It is the continuation of the current situation and faces no barriers.

Scenario iii - Destroyed via flaring
Destroying methane by flaring does not utilize the energy potential of CMM, but requires great investment without any revenue. Thus *Scenario iii* faces investment barriers and will be eliminated.

Scenario iv - Use for additional grid power generation
This is the proposed project activity not implemented as a CDM project. This scenario is technically feasible as many CMM power generation projects have been carried out in China. However, as described in B.5, this scenario faces significant investment barriers. Therefore the scenario is eliminated.

Scenario v - Use for captive power generation
The electricity purchased price was published by Shanxi province on 20 Sep 2009 as 0.4521 RMB/Kwh (VAT included)[49]. Purchase invoices also provided for crosscheck.

Self-captive power generation financial analysis result shows the IRR (before tax) is: 11.73%[50] lower than 13%, the benchmark of mining industry. Therefore, scenario v is eliminated.

Scenario vi: Use for additional heat generation
Both the coal fired boilers and gas fired boilers belong to the Yuecheng coalmine. And both the coal and CMM gas produced by the coalmine themselves as well. Therefore, there is no cost to the Yuecheng coalmine of using either coal or CMM gas. With no saving in the fuel cost, fuel switching does not have any revenue for the coalmine. However, whether purchasing new gas-fired boilers or making the retrofitting on the existing coal-fired boilers requires investment from the Yuecheng coalmine. It is not possible for the coalmine to invest into a project without any revenue. This scenario is eliminated.

Scenario vii - Feed into pipeline (used by vehicles or used for power or heat generation)
There is no existing pipeline. A financial analysis of building pipeline and selling CMM gas to the nearest town Yangcheng (over 30 km away from the Yuecheng coalmine) shows that the IRR before tax is -2.87% and after tax is -0.81% and both the before tax and after tax NPV are negative[51], therefore this scenario is eliminated.

Scenario viii - The combination of scenarios i and vii.
As analyzed above, scenario ii，iii，iv ，v，vi，vii are not feasible scenarios therefore scenario viii is eliminated from baseline scenario.

As a result of above consideration, **Scenario i** (business as usual scenario) is the only scenario that does not face prohibitive barriers. Therefore, it is considered to be the baseline scenario.

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[49] http://www.shanxigov.cn/n16/n37141/n37756/n37951/n39226/15724891.html

[50] Yuecheng project scenario v financial analysis

[51] Yuecheng project scenario vii financial analysis

4c. Barrier analysis made on baseline alternatives for energy production

Power generation:

Scenario P1
Purchasing electricity from the North China Power Grid is the continuation of the current situation and faces no barriers.

Scenario P3
According to the analysis made in B.5, the project is not financially attractive. Therefore, Scenario P3 faces investment barrier and should be eliminated.

Thermal energy production:

Scenario T1: Continuation of existing situation- coal and gas-fired boilers for thermal energy;
There is no barrier for this option.

Scenario T2; Waste heat recovery from power plant;
Heat exchangers will capture the waste heat from gas engines and could be used for thermal energy production. However, as discussed in B.5, building a CMM power generation plant without the revenue from CERs faces investment barriers. As there is no waste heat to recover without the existence of the CMM powerplant, *Scenario T2* will be eliminated.

Step 5. Identify the most economically attractive baseline scenario alternative

It could be concluded from the above analysis that the baseline scenario of this project is the combination of Option C, *Scenario i* and P1 and T1, namely, the continuation of the current situation at Yuecheng Coal Mine where;

- The North China Power Grid provides electricity
- Post and Pre mining CMM is extracted and;
- Partial venting of pre-mining CMM/post-mining CMM, where remaining CMM is used for residential purposes, in on-site boilers and at various related coalmines[52]

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):

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CDM consideration
CDM was seriously considered during the development of the Project, the timeline of the Project implementation is shown in the following table.

Table B.5-1 Timeline of the Project Implementation

Time	Milestones

[52] Such usage is not related to the proposed project or the project owner and will remain outside of the project boundary. Based on the data from "Yuecheng gas drainage and usage record in 2010" and the estimated pure CH_4 usage amount of the proposed project based on FSR, the annual drainage amount of pure CH_4 from Yuecheng Coalmine is 14.75% more than the total usage amount presently and in the proposed project. Therefore, these usages have no impact upon each other

18/05/2010	Decision of the board meeting on CDM development
06/2010	FSR completion (including CDM consideration)
29/06/2010	EIA completion
20/07/2010	Approval of EIA
27/09/2010	CDM consultant contract
09/11/2010	ERPA signed
31/12/2010	Approval of FSR
15/03/2011	Informed Chinese NDRC of the project statues for seeking the help of CDM
16/03/2011	Informed UNFCCC of the project statues for seeking the help of CDM
29/04/2011	Equipment contract signed (the starting date of the project)
8/05/2011	Construction started（construction contract signed）
6/2012	Expected Commissioning date of the project

The additionality of the project activity will be demonstrated and assessed by using the "Tools for the demonstration and assessment of additionality" (version 06.0). Step 1 of the tool can be ignored in accordance with ACM0008.

Step 2. Investment analysis
The additionality of the project is going to be established by conducting the **Step 2: Investment analysis.** It is to determine whether the proposed project activity is economically or financially less attractive than other alternatives without the revenues from the sale of certified emission reductions (CERs). To conduct the investment analysis, the following sub-steps will be followed:

Sub-step 2a. Determination of the appropriate analysis method
The "Tools for the demonstration and assessment of additionality (version 06.0)" recommends three analysis methods, including simple cost analysis (Option I), investment comparison analysis (Option II) and benchmark analysis (Option III).

As the proposed project activity generates revenue from both the sale of electricity and CDM participation, 'Option I - Simple cost analysis' cannot be used.

'Option II – Investment analysis comparison' is also not applicable due to the lack of similar alternative investment projects. While the flaring of CMM is technically feasible and complies with the relevant regulations in China, it is not a mandatory requirement for coalmines[53]. As indicated above under '2. Options for extracted CMM Treatment', the alternative baseline scenario identified for the project activity is the continuation of venting at the Yuecheng Coal Mine rather than a new investment project (i.e. flaring). Also, as the flaring of CMM, as an alternative to the project activity, generates no income stream, it cannot be considered a similar activity suitable for an investment comparison. Additionally, it must be noted that the mine owner and the project owner are different entities. The project owner is purely a power generation company and has no interest in the construction or involvement in the flaring of CMM. Therefore, an investment comparison analysis of other project alternatives involving the PO is unsuitable and Option II will not be used.

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[53] At present, methane control requirements in these laws and regulations are only for health and safety purpose. Each coalmine is obliged to extract a certain amount of CMM prior to their coal mining activities but there exists no mandatory requirements on the utilization or treatment of the extracted gas

Therefore, 'Option III – Benchmark analysis' will be used to demonstrate the additionality of the project.

Sub-step 2b. Benchmark analysis (Option III)

The indicator to be used for financial analysis of the project activity is selected to be the Project Internal Rate of Return (IRR) in accordance with the "Tool for the demonstration and assessment of additionality (version 06.0)".

The benchmarks considered for this project were; coal mining, 13% (before tax); electricity generation, 8% (before tax) and gas drainage on the land, 12% (before tax). These figures are all in accordance with the "Economic Evaluation Method and Parameters for Construction Projects (Version 03)[54]". The following shows the process used to determine the most applicable benchmark.

As the coalmine is not owned by the project participant and the project participant does not sell gas, the benchmark of coal mining and gas industries cannot reflect the project financial situation. The project participant is only engaged in their core business of electricity generation. Furthermore, the vast majority of electricity finally supplied to the NCPG (North China Power Grid) is generated using fossil fuel, so the benchmark of this project is chosen as the benchmark of the fossil fuel electricity generation industry.
Therefore, the benchmark value of the project IRR for electricity generation (total investment, before income tax) is chosen to be 8%.

Sub-step 2c. Calculation and comparison of financial indicators

The basic data used for the IRR calculation are listed in Table B.5-2. Explanation and justification for each of the primary parameters is given below.

Table B.5-2 Basic data used for the IRR calculation

Parameters	Value	Sources
Installed capacity	20MW	Section 1.2 of FSR (p.3)
Annual electricity (net of auxiliary consumption)	103,680 MWh	Section 1.2 of FSR (p.3)
Annual electricity exported to grid (net of auxiliary consumption and supply to Yuecheng coalmine)	100,080MWh	Section 1.2 of FSR (p.3)
Annual Operating Hours	7200 hours	Section 1.2.5 of FSR (p.11)
Total static investment[55]	129.5 million RMB	Section 7.5 of FSR (p.50), Section 1.3.2 of FSR (p.18)

[54] "Economic Evaluation Method and Parameters for Construction Projects/Version 03", China Plan Press, 2006.

[55] The total static investment figure used for the financial analysis of the project excludes the cost of setting up the WHR facility (see the discussion of the Project Boundary in Section B.3 for details). The total static investment given here is the result of 135.2 million RMB – 5.7 million RMB = 129.5 RMB. Refer to the IRR calculation and the FSR references provided. Additionally, the '*WHR equipment purchase contract'* issued by Jincheng City Jichai Commerce Co. Ltd. on 27th 2011 shows the actual cost of the WHR equipment purchase to be 4.8 million RMB, demonstrating that the FSR estimate of 5.7 million is conservative.

Operation and Management cost	17.7006 million RMB	Section 7.7 of FSR (p.51)
Operation and Management costs including:		
➢ Raw material (gas cost)	12.0681 million RMB	Section 7.7 of FSR (p.51)
➢ Fuel Expense[56]	0.4549 million RMB	Section 7.7 of FSR (p. 51)
➢ Salary and Welfare	0.4925 million RMB	Section 7.7 of FSR (p.51)
➢ Repair Fee[57]	3.8851 million RMB	Section 7.7 of FSR (p.51)
➢ Other operation fee	0.8 million RMB	Section 7.7 of FSR (p.51)
Electricity tariff	0.38 RMB/kWh (with tax)[58]	Section 7.6 of FSR (p.50)
Project lifetime	11 years	Main equipment lifetime evidence[59]
Revenue Tax	25%	Section 7.6 of FSR (p.50)
Value added tax rate	17%	Section 7.6 of FSR (p.50)
City Maintenance and construction tax rate	5%	Section 7.6 of FSR (p.50)
Educational Surcharge rate	3%	Section 7.6 of FSR (p.50)
Crediting period	10 years	Section 7.9 of FSR (p.53)
CERs price	8€/tCO2e	Section 7.9 of FSR (p.53)

Total Static investment

The total static investment of the Yuecheng CMM utilization project is 129.5 million RMB (Section 7.5 of FSR (p.50) and Section 1.3.2 of FSR (p.18)). Using other projects in Shanxi Province registered under ACM008, the suitability of the FSR figure for total static investment can be assessed.

Project Number	Project Name	Installed Capacity (MW)	Total Static Investment	RMB per MW
3219	SDIC Xiyang Baiyangling CMM to power generation project	16	169,918,400	10,619,900
5227	Jilin Hunchun Coal Mine Methane (CMM) Power Generation Project	4	22,670,000	5,667,500
3661	Shaanxi Tongchuan Huachen 7MW CMM Power Generation Project	7	38,000,000	5,428,571
3200	Qinxin CMM Power Generation Project	6	48,648,527	8,108,087
3542	Sichuan Guang'an Caishandong Coal Mine CMM Power Generation Project	15	78,320,000	5,221,333
4098	Shanxi Herui Coal Mine Methane Power Generation Project	45	336,200,000	7,471,111
4534	Shanxi Wangpo Low Concentration Coal Mine	7	59,020,000	8,431,428

[56] Previously 4597 To be conservative, the water consumption of the project has been halved due to the removal of the WHR component from the project boundary

[57] As repair fee is calculated as 3% of total static investment, the change to total static investment from the removal of the WHR boilers has also reduced the repair fee.

[58] http://www.sxprice.gov.cn/sy/tzgg/20091209/084629.html

[59] '*Generator lifetime evidence'* issued by Jichai Green Power equipment Co. Ltd. on 21 July 2011

	Methane Utilization Project			
n/a	Proposed Project	20	129,503,900	6,475,195

It can be seen through comparison with other registered projects that the total static investment figure given by the FSR is very reasonable when considered by RMB/MW.

Operating Costs:
The operating costs given in the FSR and used in the financial analysis of this project are further detailed below. A justification of their suitability has also been provided to demonstrate the conservative nature of their estimation. Each of the primary operating costs given in Table B.5.2 is examined below:

Raw Material (12.0681 million RMB Yuan):
The raw material cost given here constitutes the cost of purchasing the CMM consumed by the project activity. The relevant constituents of this cost are the CMM gas consumption and the CMM Price, each of which is specified in the FSR (p.50) as follows:

$$109{,}710{,}000m^3 * 0.11RMB/m^3 = 12{,}068{,}100 \text{ RMB/year}$$

The estimate of CMM gas consumed by the project is calculated from the expected consumption of the installed equipment. As the project has not yet commenced operation, no actual gas consumption data is available.

The estimate of CMM Price is explained and considered in its wider context in the section below and also above, under the analysis of *Scenario v* at Step 4b of the Baseline analysis.

Fuel Expense (0.4549 million RMB Yuan):
The Fuel Expense considered in the financial analysis of the proposed project is the combination of engine oil and cooling water costs. It has been calculated using the respective values for their price and volume as given in the FSR (p.51). This is represented below:

37,500L * 12 RMB/L + 2,428t[60] * 2RMB/t = 454,900 RMB/year

Regarding the consumption of engine oil, the equipment purchase contract between PP and the equipment supplier states: the engine oil consumption is less than or equal to 1.0 gram/Kwh[61]. Therefore, given the gross electricity generation of the proposed project is 115,200,000kWh, up to 115,200kg of oil could be required each year, which equates to over 130,000 litres. Therefore, this estimation in the FSR can be considered extremely conservative. The price of engine oil purchase is given as 12 RMB/L in the FSR. Given the extremely conservative nature of the engine oil quantity estimate, it is most likely that the overall cost of engine oil will be conservative.

With regard to the cost of water, the Jingcheng City price database gives a price for water used in industrial uses of 6.96 RMB/t[62]. Therefore, the estimated cost of 2 RMB/t for water in the FSR can be considered

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[60] To be conservative, only half the volume of water given in the FSR will be used in the financial analysis of the project as the WHR component has been removed from the project boundary. This is a very conservative reduction to project costs.

[61] *"Yuecheng engine oil consumption evidence"* issued by Shandong Jichai Green Power Driving Equipment Co., Ltd. in April 2010.

[62] The price for water used for industrial purposes issued by the Jingcheng City price database, available at http://jcwj.jconline.cn/Contents/Channel_5808/2009/0826/252230/content_252230.htm and dated 18/5/2011.

conservative. As the actual water consumption of the project can vary for a range of technical reasons, and is not easily compared, this conservative estimate for price will ensure that the stated costs are conservative overall.

Salary and Welfare (0.4925 million RMB Yuan):
Given the project employed 30 persons, at 1,200 RMB/month and a welfare rate of 14%, the Salary and Welfare costs of the project as calculated as follows

1,200 RMB * 12 * 30 * 1.14 = 492,480 RMB/year

It can also be seen that the salary paid to each employee is 16,416 RMB/year (1,200 * 12 * 1.14). In comparison, the average salary for workers in the Shanxi Province in 2010 was 33,544 RMB/year (a 17.8% increase on the 2009 salary)[63]. Furthermore, the same source shows that the average salary in the power generation industry in 2010 was 48,323 RMB/year (a 13.3% increase on the 2009 salary). As both these rates far exceed the FSR estimations, the salary rate used in the financial analysis of this project can be considered conservative.

The number of staff employed by the project is also detailed in the FSR. Section 1.2.4 (p.7-8) describes that the project will operate 24 hours a day with 3 shifts per day. 1 supervisor, 26 technicians and 3 Accountant/bookkeepers/management personnel will be employed. The number of full time staff employed by the proposed project can be justified through comparison with other registered projects on a staff/MW basis. Using other projects in Shanxi Province registered under ACM008, the suitability of staff numbers can be assessed.

Project Number	Project Name	Installed Capacity (MW)	Staff Number	Staff per MW
3219	SDIC Xiyang Baiyangling CMM to power generation project	16	26	1.625
5227	Jilin Hunchun Coal Mine Methane (CMM) Power Generation Project	4	15	3.75
3661	Shaanxi Tongchuan Huachen 7MW CMM Power Generation Project	7	20	2.86
4534	Shanxi Wangpo Low Concentration Coal Mine Methane Utilization Project	7	36	5.14
n/a	Proposed Project	20	30	1.5

It can be seen from the analysis above that the number of staff employed by the proposed project is very reasonable when compared to other registered projects on a staff/MW basis. Therefore the Staff and welfare costs given in the FSR can be considered conservative.

Repair Fee (3.8851 million RMB Yuan):
The repair fee for the project is calculated using the total static investment and a percentage rate for annual ongoing maintenance. In the proposed project the FSR (p.51) confirms the rate is nominated to be 3%,

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[63] The average salary of different industries, National Bureau of Statistics of China, available at; http://www.stats.gov.cn/tjfx/jdfx/t20110503_402722855.htm

therefore the total repair cost can be calculated as:

129,503,900 RMB * 0.03 = 3,885,117 RMB/year

The adoption of a 3% repair rate is in line with other recently registered projects also using ACM0008. The table below demonstrates this:

Project Number	Project Name	Repair Rate
3219	SDIC Xiyang Baiyangling CMM to power generation project	5%
5227	Jilin Hunchun Coal Mine Methane (CMM) Power Generation Project	3%
3661	Shaanxi Tongchuan Huachen 7MW CMM Power Generation Project	2%
3542	Sichuan Guang'an Caishandong Coal Mine CMM Power Generation Project	3%
n/a	Proposed Project	3%

Other operating fees (0.8 million RMB Yuan):
While the FSR does not specify exactly what will constitute the other operating costs, it is common for such developments to allocate a small amount of money to cover unexpected emergencies, cleaning, training and public relation costs etc. The table below compares the other operation costs per MWh with a number of other similar registered projects.

Project Number	Project Name	Net Generation (MWh)	Other management costs	Cost per MWh
3219	SDIC Xiyang Baiyangling CMM to power generation project	97,978	5,184,000	52.9
5227	Jilin Hunchun Coal Mine Methane (CMM) Power Generation Project	20,520	225,000	10.96
3661	Shaanxi Tongchuan Huachen 7MW CMM Power Generation Project	34,927	352,800	10.1
3200	Qinxin CMM Power Generation Project	30,744	938,000	30.5
n/a	Proposed Project	103,680	800,000	7.99

As seen the above, the other operating costs assumed by the project are very reasonable.

The value of all O&M parameters given in the FSR was the best possible estimate available to the PO at the time of the investment decision.

CMM Gas Price
As stated on the CMM purchase agreement[64] between the project owner and the coalmine owner, the CMM price was stipulated as 0.11 RMB/m^3 when the PP made the investment decision on the proposed project

[64] '*CMM purchase agreement'* signed by the Jincheng Coalmine Group Qinxiu Coal Co. Ltd. (owner of Yuecheng Coalmine) and Jicheng Runhong Power Generation Co. Ltd (the PO) and dated 17/12/2009

(CMM gas has a concentration of 35% methane). As a part of this agreement, the proposed project is also required to supply 3600MWh of electricity back to the coalmine annually via the grid. The financial analysis of the project was made based on this price, in accordance with paragraph 6 of *Annex 5 – Guidelines the Assessment of Investment Analysis*.

Although the CMM will be vented by the coalmine, the CMM does have commercial value simply due to its high calorific value. The CMM price was negotiated by the coalmine owner and the project proponent based on the local policy and referred to the market value of CMM. In item 2 of the Notice Regarding CMM Pricing, Jincheng City Pricing Bureau (No. 301 of 2003) states that "pricing for the CMM from the mine (gas source) to the gas storage tank. The CMM price is determined based on the cost and benefit of CMM utilization and ultimate market consumer price. The unit price of CMM gas with 40% methane concentration is 0.15 RMB/m^3. For every 5% increase of concentration, the price is to be added with 0.01 RMB/m^3". However, it was recognized by the project proponent that it is not entirely transparent how the CMM price was determined by the Jincheng government. Therefore, it is not clear which aspects of the CMM extraction and supply are included in the fixed CMM price. It can be a credible reference for pricing procedure. The concentration of methane in the CMM sold to this project activity is 35%, considering the inflation from year 2003 to year 2009, the price of 0.11 RMB/m^3 for the proposed project is conservative.

Evidences can be found that the CMM gas also has a local market value. Nine coalmines in Jincheng City sold CMM to Jincheng City Fengrun CMM Utilization Co., Ltd. for power generation with the price of 0.15 RMB/m^3 (with 40% of methane). Chengzhuang Coal Mine in Jincheng City sells CMM gas to the Shanxi Jinju Meidianhua (Joint Stock) Co., Ltd. at the price of 0.4RMB/m^3 (100% methane). Daning coal mine in Yangcheng County sold CMM to Shanxi Lanhua Daning Power Generation Co. Ltd. for power generation with the price of 0.37 RMB/m^3 (100% of methane).

Yuecheng coalmine locates in rural area. The nearest small town, Yangcheng, is over 30 km away. Before the proposed project, there was only limited demand of CMM gas from coalmine itself and local residental households. As shown in the existing drainage record, these 2 demands together hold less than 10% of the total extracted volume. There is not existing pipeline to distribute the extracted CMM gas to other users and the financial analysis of scenario vii also proved that construction of such pipeline is not financially feasible. There is not any other company or organization in the coalmine area can consume the remaining extracted CMM gas neither. Venting into atmosphere does not mean CMM gas is a waste without value; it is because the thermal value of the CMM gas could not be realized until the proposed project was set up. According to "Opinions on development of private capital into Energy section" published by NDRC on 6th July 2012, Chinese government supports the pricing mechanism of seam gas, coalmine methane and coal gas based on the demand/supply. Jincheng city government issued "CMM gas price guideline" on 28 Oct 2008. These references prove that there is market price for CMM gas and the pricing mechanism is supported by the government in China.

In order to supply the extracted CMM gas to the proposed project, the Yuecheng Coalmine needs to invest in transmission equipment and facilities and also pay for the O&M costs in the operation. In order to demonstrate the CMM price in the proposed project is reasonable, we made a financial analysis of selling CMM gas by the Yuecheng Coalmine. In the analysis, 2 incomes were included as:

- Selling CMM gas and electricity saving;
- Electricity saving (as gas supply contract, PP has obligation of providing required electricity from the coalmine)

Also, as tax policy [2007] No. 16 (started from 1st Jan 2007) published by China Ministry of Finance & China National Taxation office on 07 Feb 2007: "For the companies extracting and selling the CMM gas, the VAT should be pre-paid and then refunded." By applying this VAT preferential policy to the financial analysis; Yuecheng coalmine achieves higher IRR after tax than before tax. Please note: VAT return can

only be achieved when the coalmine extract and sell the gas, this is another reason that why coalmines prefer selling the CMM gas rather than using them.

Financial analysis shows that the IRR before tax is 12.07% and the IRR (after tax) is 14.01%. The result is higher than both 13%, the benchmark of mining, and 12%, the benchmark of CMM gas production. Based on the statement above and financial analysis, CMM selling price as 0.11 RMB/m3 is reasonable.

Considerations on government subsidies
The FSR of this project was completed in June 2010 and was approved by local authority in December 2010. Before the investment decision was made, the available government subsidies on CMM are:

i. "*Notification on Speeding Up the Implementation of the Tax Policy on the Coal Mine Methane Extraction*", issued by the State Administration of Taxation and the Ministry of Finance in February 2007[65]. This Notification indicates that, for enterprises specialized in CMM extraction, the VAT from selling the CMM gas can be refunded. The project owner is not an "enterprises specialized in CMM extraction" but a power generation company and thus this subsidy cannot be applied to this project.

ii. "*Implementation Suggestions on Accelerating the Comprehensive Treatment and Utilization of CMM*", issued by Government of Shanxi Province published in October 2007[66].This is a detailed local implementation guideline of the above "Notification on Speeding Up the Implementation of the Tax Policy on the Coal Mine Methane Extraction". The project owner is not an "enterprises specialized in CMM extraction", therefore such subsidy cannot be applied to this project.

iii. "*Executing Opinion on Subsidizing CBM/CMM Development and Utilization Enterprises*", issued by the Ministry of Finance published in April 2007[67]. According to the Executing Opinions, the CMM utilization enterprise could be qualified for an incentive of 0.2RMB/m^3 pure methane from central government. However, this regulation clearly states it is not applied to the CMM used for power generation.

iv. "*Implementing Opinions on Power Generation by Utilizing CBM/CMM*", issued by National Development and Reform Commission published in April 2007[68].As per the regulation, grid companies are not allowed to refuse to purchase power produced by CMM/CBM and the on-grid tariff of CBM/CMM power shall be determined by reference to the tariff for biomass-fired power plants set out in the Tentative Management Measures for Pricing and Expense-sharing for Electricity Generated from Renewable Energy, which is the sum of the benchmark on-grid tariff of the provincial desulfurized coal-fired generators in the year of 2005 and a subsidy tariff of 0.25RMB/kWh.

However, this policy was not being enforced. According to a study conducted by the International Energy Agency and published in 2009[69]. "The subsidies and priority grid access policies that were enacted in April 2007 are not being enforced. For instance, none of the interviewees for this study were aware of a project that has received the subsidy, suggesting that it has not been widely publicized or exercised."

Table B.5-3 shows the calculated project IRR with and without CDM revenues. It could be noted that the project IRR without CDM revenues is 2.21%, which is lower than the benchmark value (8%). It means

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[65] http://www.chinatax.gov.cn/n480462/n480498/n575817/5137990.html

[66]http://www.chinalawedu.com/news/1200/22016/22027/22344/22361/2007/11/li62072341251621170022180l-0.htm

[67]http://www.hnmcq.com/Article_Show.asp?ArticleID=409

[68]http://www.gov.cn/zwgk/2007-04/16/content_583702.htm

[69]International Energy Agency, Coal Mine Methane in China, A Budding Asset with the Potential to Bloom, 2009 (p29) available at http://www.iea.org/textbase/papers/2009/china_cmm_report.pdf

that the project is not financial attractive. After taking CDM revenues into consideration, the project IRR amounts to 36.12% that is higher than the benchmark value. Therefore the CDM revenues could enable the project to overcome the investment barrier and make it become feasible.

Table B.5-3 Comparison of the project IRR with and without CDM revenues

	IRR (total investment, before income tax)
Without CDM revenues	2.21%
With CDM revenues	36.12%
Benchmark value	8%

Sub-step 2d: Sensitivity analysis

The sensitivity analysis shall show whether the conclusion regarding the financial attractiveness is robust to reasonable variations in the critical assumptions. For such purpose, following parameters were selected as sensitive factors to check out their effects on project IRR.

1. Total static investment
2. Electricity tariff
3. Annual operating cost
4. Annual power supply

The project IRR will fluctuate with the variations (-10% to 10%) of the above four factors. The result is demonstrated in Table B.5-4.

Table B.5-4 Sensitivity analysis

Parameter	10%	5%	0	-5%	-10%	Critical point
Total static investment	0.16%	1.15%	2.21%	3.35%	4.58%	-22.12%
Annual power supply	5.91%	4.10%	2.21%	0.23%	-1.88%	16.05%
Annual operating cost	0.01%	1.13%	2.21%	3.27%	4.30%	-29.05%
CMM Cost	0.73%	1.48%	2.21%	2.94%	3.64%	-42.65%
Electricity Tariff	5.91%	4.10%	2.21%	0.23%	-1.88%	16.05%
Benchmark value	8%	8%	8%	8%	8%	

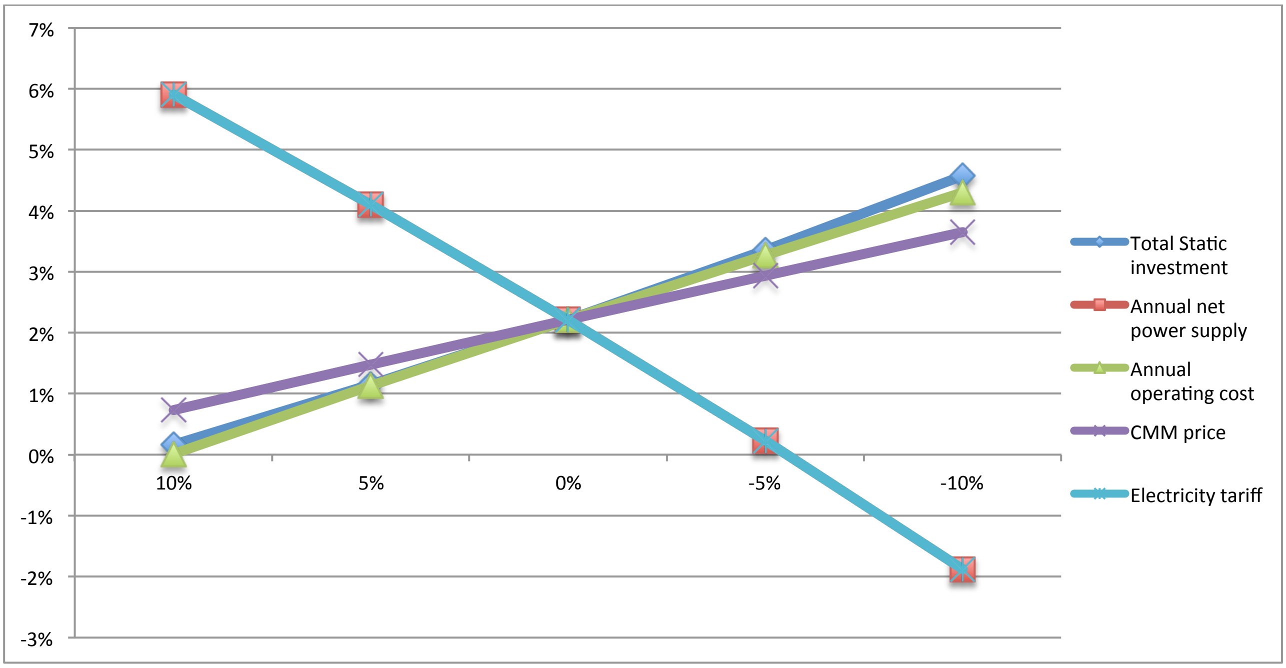

Figure B.5-1 – Sensitivity Analysis

The analysis below shows at what point the IRR of the project will rise above the benchmark:

Total static investment would need to decrease by 22.12% for the project to exceed the benchmark. This scenario is extremely unlikely to happen as costs of this type (e.g. materials. equipment) have been increasing in China in recent years[70].

Similarly, annual power supply would need to increase by 16.05% for the project to exceed the benchmark. An increase of this amount is not plausible because of the volume of CMM, so the IRR won't rise above the benchmark. Additionally, the maximum operation time and electrical output of the generators will not exceed the levels used in the IRR calculation due to technical limitations. The manufacturer has evidenced that running generators at the higher than recommended continuous operation rates will result in more maintenance time and a more rapid degradation of equipment[71]. Therefore, an increase in these factors (and hence the IRR) is impossible.

For annual operating cost, annual O&M costs would need to decrease by 29.05% for the project to go over the benchmark. Again, a decrease of this amount is not plausible, particularly during a period of price increases.

For CMM price, CMM price would need to decrease by 42.65% for the project to go over the benchmark. According to Gas purchase and supply agreement between the project owner and Yuecheng coal mine[72] and the PO, CMM used for project activity is purchased at the stated fixed price in project implementation.

[70] According to the China Statistical Yearbook, in 2003, 2004, 2005 , 2006,2007 and 2008， the national general growth rate of purchasing prices of raw materials, fuels and power ; the national total price indices of total static investment was increased respectively. See http://www.stats.gov.cn/tjsj/ndsj/2009/indexch.htm

[71] *'Yuecheng generator operation hour and efficiency evidence'* issued by Jichai Green Power Equipment Co. Ltd. on the 23rd February 2012.

[72] '*Yuecheng CMM purchase agreement'* signed by the Jincheng Coalmine Group Qinxiu Coal Co. Ltd. (owner of Yuecheng Coalmine) and Jicheng Runhong Power Generation Co. Ltd (the PO) and dated 17/12/2009

The price is regulated and determined according to the average cost and market supply.

For electricity tariff the electricity generated by this project will be sold to the power grid at specified tariff. This would need to increase by 16.05% for the project to go over the benchmark. The Chinese Government will only order an adjustment in the electricity tariff after internal negotiations between several government departments. It is difficult to forecast these adjustments. In China electricity is a necessary input for people's daily life and industrial operation; therefore the electricity tariff has a significant impact on social stability and the national economy[73]. In order to maintain social stability and economic growth, the electricity tariff is strictly regulated by the Chinese Government and is not expected to fluctuate significantly. It is very unlikely that the electricity tariff will appreciate by more than 16.05%.

Before the FSR was completed and the investment decision was made on 2010, the Pricing Bureau of Shanxi Province published the power tariff for CMM power generation in 2010. The tariff was stipulated as 0.38 RMB/kWh (Inc. VAT). As the proposed project is still in the construction stage, the local government has only issued approval to supply electricity to the grid[74]; the electricity tariff itself will be specified in the grid connection agreement to be issued following the commissioning of the project.

Table B.5-4 identifies the four key parameters that will influence the projects IRR; the project IRR will always be lower than the benchmark IRR. The sensitivity analysis shows that it will not be possible to increase the project IRR above the benchmark value without the revenues from CERs. It is always true that the project activity is not financially attractive without the CDM revenues.

Step 3: Barrier analysis
According to the "Tool for the demonstration and assessment of additionality" the adoption of this step is not required because step 2 – investment analysis – is carried out.

Step 4: Common Practice Analysis

Within Shanxi Province, 59 projects were identified for consideration in the Common Practice Analysis using the following sources:

- Shanxi NDRC, Shanxi Provincial government website. Register of all approved electricity generating projects with approval to export electricity to the power grid. Available at: http://www.sxdrc.gov.cn/xxlm/lxsp
- Clean Development Mechanism in China government website (CMM power generation projects with China LoA). Available at http://cdm.ccchina.gov.cn
- UNFCCC website (Registered CMM power generation projects or the projects in the UNFCCC validation process)

Sub-step 4a. Analyze other activities similar to the proposed project activity

According to the *Tool for the demonstration and assessment of additionally (Version 6.0)*, projects are considered similar in case they are "located in the same country/region and/or rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc."

The scope of similar projects used for common practice analysis is defined as follows:

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[73] Rate of purchasing prices of raw materials, fuels and power ; the national total price indices of total static investment was increased respectively. See http://www.stats.gov.cn/tjsj/ndsj/2009/indexch.htm

[74] '*Grid connection approval'* issued by Shanxi NDRC on 17th May 2011

i. Shanxi province is selected as the region for the common practice analysis, for reasons as follows:
- NCPG encompasses 6 provinces, cities and autonomous regions (Shandong, Beijing, Tianjin, Hebei, Shanxi and Inner Mongolia), this areas is a large geographical region with a population of 230 million residents.
- A number of key economic factors vary from province to province including: tariff rates on products, the cost of materials, the cost of electricity and other utilities such as water, the cost of labour and services and the types of loans that can be obtained; all of which alter the investment climate between provinces.
- Shanxi is the province with the largest coalmine reserves in China, 27.02% of the total reserve in China[75]" and is a good representative area to conduct a common practice analysis.

Therefore, only projects within the same province can be truly comparable.

ii. Projects with installed capacities within a range between -50% and +50% of the proposed project and employing the same technology are defined as comparable projects. This is because different project scales may lead to variations in the ratio of investment risk and ongoing cost and operation cost etc. Based on this principle, projects with installed capacities between 10 MW and 30 MW are included in the range of similar projects.

iii. Projects employing both domestic and foreign technologies using CMM to generate electricity are included in the range of comparable projects.

In total, 59 CMM utilisation projects were identified in Shanxi Province and examined for the common practice analysis. Firstly, a +/-50% range was applied to the proposed project's output to determine the comparable capacity range to be used in the analysis. Within the comparable range (10MW - 30MW), 23 other projects were identified and are given in the table below:

	Project Name	**Installation capacity**	**Applied for CDM**
1	Shaqu 14MW CMM Power Generation Project in Shanxi Province (Phase I)	14 MW	Yes (3190)
2	Shanxi Yaoyuan Coal Mine Methance Developing Co., Ltd, Coal Mine Methance (Coal Mine Gas) Unilization (Nanyu) Project	10MW	Yes Webhosted (UNFCCC)
3	Coal Mine Methane (CMM) and Ventilation Air Methane (VAM) Comprehensive Utilization Project of Taiyuan, Shanxi Province	10MW	Yes Webhosted (UNFCCC)
4	Yanguan Nanmei (Group) Co. Ltd. Coalmine Methance Utilization Project (Project set up two separate 5 MW power plants at Nanzhuang and Dayangquan Coalmine).	10 MW	Yes (3016)
5	This project is part of the registered project Yangquan Coal Mine Methane (CMM) Utilization for Power Generation Project, Shanxi Province, China (0892)	25MW	Yes (0892)
6	Xingyu Coal Mine CMM to Power Generation Project	10 MW	Yes

[75] '*Shanxi Coal reserve evidence'* issued by Shanxi Province NDRC on 12th October 2008 and available at http://www.shanxigov.cn/n16/n8319541/n8319612/n8321708/n8321873/8394807.html

			Webhosted (UNFCCC)
7	Wujia coalmine power generation project	10MW	Yes Webhosted (UNFCCC)
8	SDIC Xiyang Huangyanhui CMM to Power Generation Project	16MW	Yes (3219)
9	Jincheng Chengzhuang 18MW coal mine methane power generation project	18MW	Yes (3179)
10	Jincheng Fengrun CMM Utilisation from Nine Mines in Jincheng City Shanxi Province China	24 MW	Yes (1928)
11	SDIC Xiyang Huangyanhui CMM to Power Generation Project	10 MW	Yes (2929)
12	Shanxi Coal Transport Market Co., Ltd. Yangquan Branch CMM Utilization Project	30MW	Yes (1319)
13	Shanxi Yangcheng Coal Mine Methane Utilization Project	16.5 MW	Yes (1250)
14	Shanxi Datuhe Coal Mine Methane Utilization Project	17 MW	Yes (1801)
15	Shanxi Liulin Coal Mine Methane Utilization Project	12 MW	Yes (1230)
16	Shanxi Qinshui Yongchanglong CMM power generation project	18 MW	Yes Webhosted (UNFCCC)
17	Shanxi Jincheng Daning Coalmine CMM power generation project (PP is Jincheng City Fengrun CMM Utilization Co. Ltd. project was set up at Daning and Nanaosi Coalmine)	15 MW	Yes Webhosted (UNFCCC)
18	Shanxi Xiyang Fenghui Coal Industry Co. Ltd. Mahui Coal Mine Utilization for Power Generation Project	10 MW	Yes Webhosted (UNFCCC)
19	Duerping Coal Mine Methane Utilization Project	12 MW	Yes (1929)
20	Shanxi Fenxi Coal Mine Methane Utilization Project The approved LoA shows the annual ER volume is 800,674 tones of CO2 per year. As the installed capacity is not visible, a +/-50% range has been calculated on the proposed project's emissions reductions. The upper 50% boundary of this is 836,128.5 tCO_2 per year. Therefore, this project is included in the common practice analysis.	NA	Yes Webhosted (UNFCCC)
21	Huineng Coal Industry 12MW CMM Power Project	12 MW	Yes Webhosted (UNFCCC)
22	Gaojiazhuang Coal Mine CMM Power Project	17.4 MW	Yes Webhosted (UNFCCC)
23	Xiyang Fengyuan Anping CMM Power Project http://www.sxdrc.gov.cn/xxlm/xny/zhdt/201206/t20120612_64893.htm	12MW	No

Project 23 in the table above is within the comparable capacity range of the proposed project and has not registered for CDM but can be ruled out as a similar projects because:

- The Xiyang Fengyuan Anping CMM Power Project (12MW) was approved by local government very recently during the month of June 2012[76] and has not yet applied for CDM. However, this project can be excluded from the analysis since it is not yet in operation.

[76] '*Xiyang County Fengyuan construction approval*' issued by Shanxi Provincial NDRC on 12/6/2012. Available at http://www.sxdrc.gov.cn/xxlm/xny/zhdt/201206/t20120612_64893.htm

Therefore, based on the analysis of the 23 projects above within the comparable capacity range:

- 12 projects were registered as CDM projects
- 10 projects are in the CDM application process
- 1 project is ruled out as it is not yet in operation

Therefore, all projects can be excluded based on the paragraph 44 of the '*Tool for the demonstration and assessment of additionality (ver 6.0)*' and it is determined that there are no similar projects to the proposed project. Therefore, proposed project is not common practice in Shanxi Province.

Sub-step 4b. Discuss any similar options that are occurring:

As demonstrated in sub-step 4a) above, all other similar projects in Shanxi province are also applying for CDM finance and are therefore excluded from the analysis. There are therefore no projects that are similar to the proposed projects that have proceeded without the CDM. This further demonstrates the barriers that the project faces and that the project is additional.

To summarize, without CERs sales revenues, the project IRR of the project activity is lower than the benchmark value and the project is therefore not financially feasible. Under such circumstances, it is difficult to implement and operate the project activity. Being registered as a CDM project, CERs sales revenues can improve the project IRR above the benchmark value thus help the project activity to overcome investment barrier. Therefore the project activity is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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The emission reductions by the project during a given year y is the difference between baseline emissions and project emissions, as follows:

$$ER_y = BE_y - PE_y - LE_y \quad \textbf{(1)}$$

Where:
ER_y: emission reductions of the project activity during the year y (tCO_2e);
BE_y: baseline emissions during the year y (tCO_2e);
PE_y: project emissions during the year y (tCO_2e);
LE_y: leakage emissions in year y (tCO_2e).

The baseline emissions, project emissions and leakage emissions have to be determined in order to calculate the emission reductions.

1. Baseline emissions:
Baseline emissions are given by the following equation:

$$BE_y = BE_{MD,y} + BE_{MR,y} + BE_{Use,y} \quad \textbf{(2)}$$

Where:

BE_y: Baseline emissions in year y (tCO_2e);

$BE_{MD,y}$: Baseline emissions from destruction of methane in the baseline scenario in year y(tCO_2e);
$BE_{MR,y}$: Baseline emissions from release of methane into the atmosphere in year y that is avoided by the project activity (tCO_2e);
$BE_{Use,y}$: Baseline emissions from the production of power, heat or supply to gas grid replaced by the project activity in year y (tCO_2e).

1.1 Methane destruction in the baseline (*$BE_{MD,y}$*)

Depending on the nature of the activities in the baseline scenario, CBM/CMM can be removed at five different stages – (1) as coal bed methane from a CBM to goaf wells prior to mining, or from underground pre-mining CMM drainage; (2) during the mining process using surface or underground post mining CMM drainage techniques, (3) during the mining process using ventilation air, (4) after the mining process by drainage from sealed goafs but before the mine is closed, or (5) as coal bed methane from a CBM to open cast mine face.

Depending on the baseline scenario, part of this methane may be destroyed in the baseline scenario through flaring, flameless oxidation, power generation, heat generation, supply to gas grid to various combustion end uses. Baseline emissions should account for the CO_2 emissions resulting from the destruction of that methane.

$$BE_{MDy} = (CEF_{CH4} + r \times CEF_{NMHC}) \times \sum_{i} (CBM_{BL,i,y} + VAM_{BL,i,y} + CMM_{BL,i,y} + PMM_{BL,i,y}) \qquad \textbf{(3)}$$

Where:

BE_{MDy}	=	Baseline emissions from destruction of methane in the baseline scenario in year *y* (tCO_2e)
i	=	Use of methane (flaring, power generation, heat generation, supply to gas grid to various combustion end uses)
$CBM_{BL,i,y}$	=	CBM that would have been captured, sent to and destroyed by use *i* in the baseline scenario in the year *y* (expressed in tCH_4)
$VAM_{BL,i,y}$	=	VAM that would have been captured, sent to and destroyed by use *i* in the baseline scenario in the year *y* (expressed in tCH_4)
$CMM_{BL,i,y}$	=	Pre-mining CMM that would have been captured, sent to and destroyed by use *i* in the baseline scenario in year *y* (expressed in tCH_4)
$PMM_{BL,i,y}$	=	Post-mining CMM that would have been captured, sent to and destroyed by use *i* in the baseline scenario in year *y* (tCH_4)
CEF_{CH4}	=	Carbon emission factor for combusted methane (2.75 tCO_2e/tCH_4)
CEF_{NMHC}	=	Carbon emission factor for combusted non methane hydrocarbons. This parameter should be obtained through periodical analysis of captured methane ($tCO_2eq/tNMHC$)
r	=	Relative proportion of NMHC compared to methane

With:

$$r = PC_{NMHC} / PC_{CH4} \qquad \textbf{(4)}$$

Where:

PC_{CH4}	=	Concentration (in mass) of methane in extracted gas (%), to be measured on wet basis

PC_{NMHC} = NMHC concentration (in mass) in extracted gas (%)

As the project activity does not include any utilization of CBM or VAM and the concentration of NMHC in the extracted gas is well below threshold, the formula is reduced to:

$$BE_{MD,y} = CEF_{CH4} \times \sum (CMM_{BL,i,y} + PMM_{BL,i,y}) \quad (5)$$

Where:

$BE_{MD,y}$ Baseline emissions from destruction of methane in the baseline scenario in year y(tCO_2e)

CEF_{CH4} Carbon emission factor for combusted methane (2.75 tCO_2e/tCH_4)

$CMM_{BL,i,y}$ Pre-mining CMM that would have been captured, sent to and destroyed by use i in the baseline scenario in year y (expressed in tCH_4)

$PMM_{BL,i,y}$ Post-mining CMM that would have been captured, sent to and destroyed by use i in the baseline scenario in year y (tCH_4)

As stated in B.3 and B.4 there is no methane destruction in the baseline scenario within the project boundary. Thus, neither baseline nor project emissions result from this emission source. Therefore, $BE_{MD,y}$=0.

<u>Calculation of the mean annual demand (Thy) for each year of the crediting period</u>

For thermal demand, which includes on-site heat generation and supply to the gas grid for various combustion end uses, demand can vary within the year. More importantly, this section presumes that such power generation (or other uses) projects are designed to primarily (or exclusively) use extracted VAM/CMM that would *not* be used for baseline thermal energy and would otherwise be emitted to the atmosphere. Figures 1 and 2 indicate the disposition of methane under the baseline and project scenarios for this type of project.

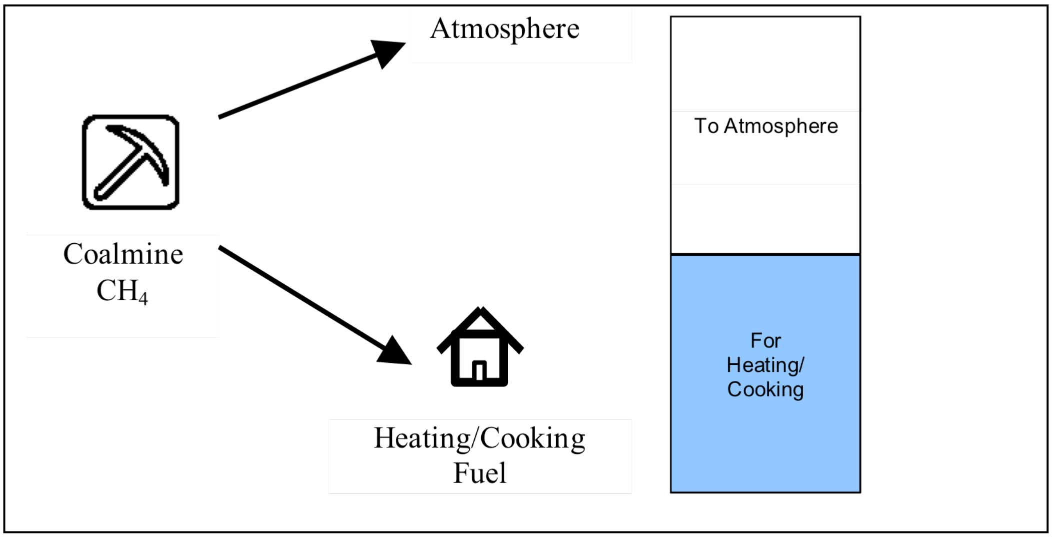

Figure 1: Baseline Disposition of VAM/CMM/CBM

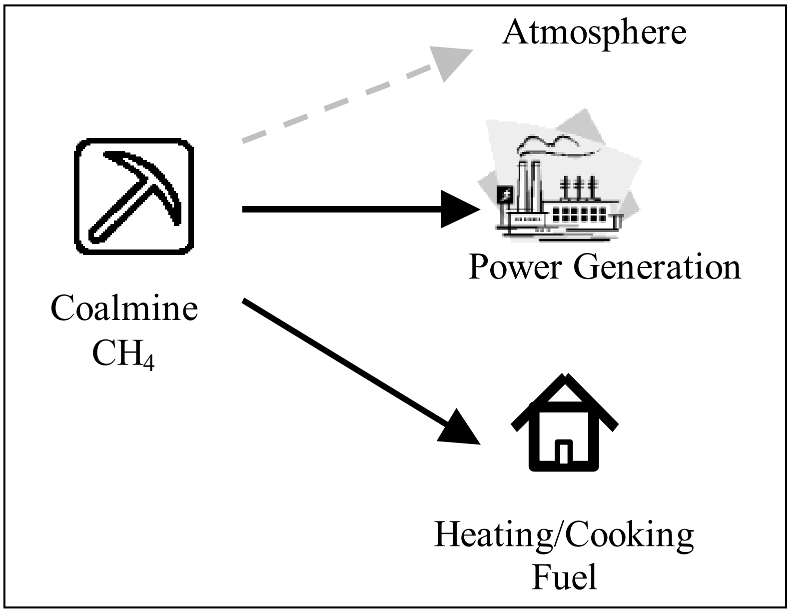

Figure 2: Project Case Disposition of VAM/CMM/CBM

For applicable projects, some or all of the VAM/CMM/CBM used to generate electricity would be emitted to the atmosphere under the baseline (Figure 1). Appropriate VAM/CMM/CBM flow and concentration meters should directly measure the amount of methane delivered to the project electric generator.

Under some circumstances, some portion of the VAM/CMM/CBM used by a project for power generation might otherwise have gone to produce thermal energy under the baseline. This situation is shown in Figure 3, indicating an "overlap" between VAM/CMM/CBM used for power and baseline use of VAM/CMM for heating/cooking. This overlap may occur if VAM/CMM flows fall below expected levels (left column at bottom of Figure 3), or if baseline thermal energy demand exceeds expected levels (right column at bottom of Figure 3). Such overlaps may occur even where total annual VAM/CMM/CBM volumes are more than enough to cover annual thermal energy and power requirements (as in Figure 3). This methodology provides for conservatively estimating what amount of methane – if any – used for power production would have been used for thermal energy in the baseline. Emissions from the project are reduced only to the extent that the power generation uses methane that would have been *emitted* in the baseline (i.e., "emitted to atmosphere" in Figure 1).

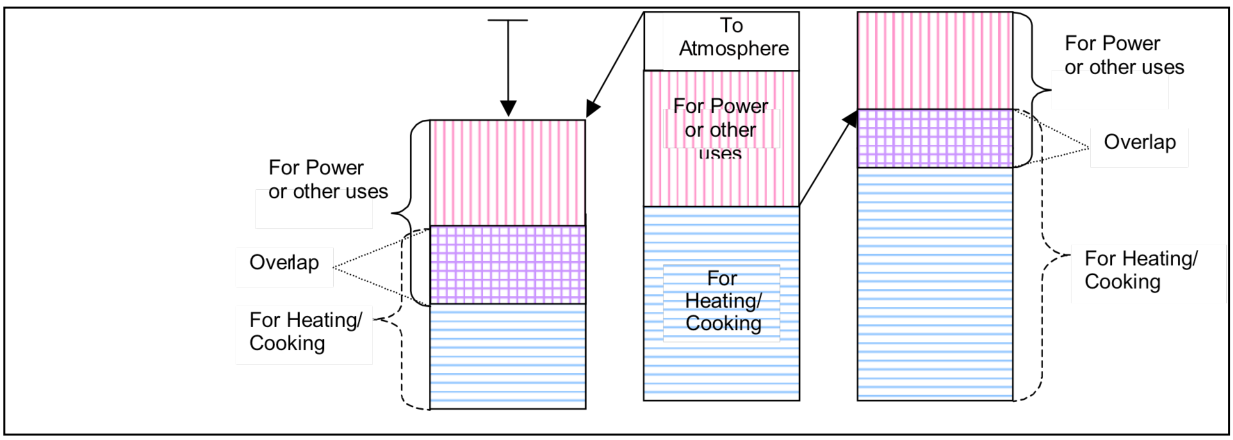

Figure 3: Project Case VAM/CMM/CBM for Power (or other uses) Overlaps with Baseline Thermal VAM/CMM

Note that even when a project's average annual VAM/CMM/CBM use for electricity generation or other uses is significantly below baseline VAM/CMM/CBM emissions, there may be times – due to daily fluctuations in thermal energy demand or in VAM/CMM/CBM extraction rates – that the project will use VAM/CMM that would have been used for thermal energy under baseline conditions. This methodology prescribes a conservative approach to account for how daily/monthly fluctuations in VAM/CMM/CBM extraction and thermal energy demand will affect actual emission reductions relative to the baseline.

The likely fluctuation around daily estimates of baseline thermal energy demand for CBM/VAM/CMM results from both:

- The expected year-to-year volatility in thermal energy demand relative to baseline projections of average demand;
- The expected day-to-day volatility in thermal energy demand, relative to average quantity required on each day.

These sources of volatility are combined into a single distribution around daily estimates of thermal energy demand. This distribution is in equation below, in which the mean daily baseline thermal demand is multiplied by the daily scalar adjustment factor, d_k^{max}. Baseline thermal demand is estimated with the following equation:

$$(VAM_{BL,th,y} + CBM_{BL,th,y} + CMM_{BL,th,y} + PMM_{BL,th,y}) = \sum_{k=1}^{365} TH_{BL,k} \qquad (6)$$

Where:

$VAM_{BL,th,y}$	=	VAM that would have been captured and destroyed by thermal demand in the baseline scenario (tCH_4)
$CBM_{BL,th,y}$	=	CBM that would have been captured and destroyed by thermal demand in the baseline scenario (tCH_4)
$CMM_{BL,th,y}$	=	Pre-mining CMM that would have been captured and destroyed by thermal demand in the baseline scenario (tCH_4)
$PMM_{BL,th,y}$	=	Post-mining CMM that would have been captured and destroyed by thermal demand in the baseline scenario (tCH_4)
th	=	Index for thermal use of CBM, VAM, CMM and PMM in the baseline, which includes on-site heat generation and supply to the gas grid for various combustion end uses
$TH_{BL,k}$	=	Methane used to serve estimated thermal energy demand in the baseline for day *k* of year *y* (tCH_4)

The quantity $TH_{BL,k}$ should be determined for each day k of the annual reporting period. For each day *k*, in a future year *y* the formula is:

$$TH_{BL,k} = \frac{TH_{BL,y}}{365} \times d_k^{max} \qquad (7)$$

Where:

$TH_{BL,k}$	=	Methane used to serve estimated thermal energy demand in the baseline for day *k* in year *y* (tCH_4)
$TH_{BL,y}$	=	Projected annual baseline thermal demand for year *y* (tCH_4)
d_k	=	Scalar adjustment factor for day k to reflect seasonal variations, such that $\Sigma d_k=365$
d_k^{max}	=	Maximum scalar adjustment factor for day *k* over the 5 years prior to the start of the project activity (i.e. $\Sigma d^{max}_k>365$)

The scalar adjustment factor for the day *k* of a year prior to the commencement of the project activity is the ratio between the demand for that day *k* and the mean daily demand for that year. For the past 5 years before the starting date of the proposed project activity, d_k is calculated using real measured data. For each year *y* of the crediting period, d_k takes the highest value observed during the 5 years before the starting date of the proposed project activity (i.e. d_k^{max}).

If daily data are not available for estimating the scalar factor d_k, then monthly data may be used.

The source of data for mean annual baseline thermal energy demand should be provided on an *ex ante projection* basis by local VAM/CMM/CBM distribution system operators, supported by a detailed description of the drivers of, and constraints on, future VAM/CMM/CBM thermal energy demand.
The project participants will use the methods below to project thermal energy demand. If using approach (b) project proponents must document why (a) cannot be used. If using approach (c) project proponents must document why neither (a) or (b) can be used.

(a) *Engineering/economic study of thermal energy demand*. Ideally, projections should be based on a detailed description of the existing VAM/CMM/CBM distribution system for thermal energy, how and why it was constructed, and what the primary drivers are behind thermal energy demand on the system. Based on this description, project proponents should describe how thermal energy demand is expected to change in the future in the absence of the project. Key points to address include:

- Who the users of VAM/CMM for thermal energy are, by quantity and type (e.g., residential, commercial, industrial);
- What service agreements are in place with these end users;
- Average VAM/CMM/thermal energy consumption rates for each type of end user;
- The number of end users serviced by the distribution system relative to the total pool of possible end users, given infrastructure constraints;
- How quickly the total pool of possible end users is expected to grow, if at all;
- Whether official plans exist to expand the VAM/CMM/CBM thermal energy system;
- The cost/benefits of expanding the VAM/CMM/CBM delivery system to additional end users;
- The type and cost of alternative fuels for potential or existing VAM/CMM/CBM thermal energy customers, compared to the cost of delivering VAM/CMM/CBM;
- Any other variables relevant to the particular thermal energy VAM/CMM/CBM distribution system associated with the project.

Project proponents should explain how any assumptions used in this analysis are conservative.

(b) *Statistical projection*. If detailed information on thermal energy demand or the existing VAM/CMM distribution system is not available, project proponents may use a statistical projection based on VAM/CMM/CBM availability and thermal energy VAM/CMM/CBM usage rates over at least the past five years. If the latter approach is used, proponents must explain why such a statistical projection is reasonable, and should supplement any projection with as much engineering/economic information as possible.

(c) *Maximum throughput on the distribution system.* Failing sufficient data for an engineering/economic assessment or a statistical projection (e.g., if less than five years of data are available), prospective thermal energy demand in the absence of the project may be estimated from the maximum amount of VAM/CMM/CBM that could be delivered to end users through existing pipelines. To be conservative, this approach should assume that thermal energy demand for VAM/CMM/CBM in all future years will be equal to the maximum amount of VAM/CMM/CBM that can be delivered. Maximum throughput estimates should be based on a detailed engineering description of the existing pipeline infrastructure. This analysis may also inform the analysis for (a) and (b), above.

1.2 Methane released into the atmosphere (*$BE_{MR,y}$*)

All the extracted coal mine gas is released into the atmosphere (except for a small amount provided to present usage) in the absence of the proposed project activity. Only the portion of CMM sent to the project activity is accounted for in this calculation. The methane that is vented in the project activity is excluded from both baseline emissions and project emissions since it is vented in both situations.

$$BE_{MRy} = GWP_{CH4} \times [\sum_i (CBMe_{i,y} - CBM_{BLi,y}) + \sum_i (CMM_{PJi,y} - CMM_{BLi,y}) + \sum_i (PMM_{PJi,y} - PMM_{BLi,y}) + \sum_i (VAM_{PJi,y} - VAM_{BLi,y})] \quad \textbf{(8)}$$

Where:

BE_{MRy}	=	Baseline emissions from release of methane into the atmosphere in year *y* that is avoided by the project activity (tCO_2e)
i	=	Use of methane (flaring, power generation, heat generation, supply to gas grid to various combustion end uses)
$CBMe_{i,y}$	=	Eligible CBM captured, sent to and destroyed by use i in the project for year *y* (expressed in tCH_4)
$CBM_{BLi,y}$	=	CBM that would have been captured, sent to and destroyed by use *i* in the baseline scenario in the year *y* (expressed in tCH_4)
$CMM_{PJi,y}$	=	Pre-mining CMM captured, sent to and destroyed by use *i* in the project activity in year *y* (expressed in tCH_4)
$CMM_{BLi,y}$	=	Pre-mining CMM that would have been captured, sent to and destroyed by use *i* in the baseline scenario in year *y* (expressed in tCH_4)
$PMM_{PJi,y}$	=	Post-mining CMM captured, sent to and destroyed by use *i* in the project activity in year *y* (tCH_4)
$PMM_{BLi,y}$	=	Post-mining CMM that would have been captured, sent to and destroyed by use *i* in the baseline scenario in year *y* (tCH_4)

$VAM_{PJi,y}$	=	VAM sent to and destroyed by use i in the project activity in year *y* (tCH_4). In the case of flameless oxidation, $VAM_{PJ,i,y}$ is equivalent to MD_{OX} defined previously
$VAM_{BLi,y}$	=	VAM that would have been captured, sent to and destroyed by use i in the baseline scenario in year *y* (tCH_4)
GWP_{CH4}	=	Global warming potential of methane (21 tCO_2e/tCH_4)

As the project activity does not include any utilization of CBM or VAM, so the formula is reduced to:

$$BE_{MR,y}=GWP_{CH4}x\left(\sum_i(CMMPJi,y-CMMBLi,y)+\sum_i(PMMPJi,y-PMMBLi,y)\right) \quad \textbf{(9)}$$

Where:

$BE_{MR,y}$	Baseline emissions from release of methane into the atmosphere in year y that is avoided by the project activity（tCO_2e）
i	Use of methane(flaring, power generation, heat generation, supply to gas grid to various combustion end users)
$CMM_{PJi,y}$	Pre-mining CMM captured, sent to and destroyed by use i in the project activity in year y（tCH_4）
$CMM_{BLi,y}$	Pre-mining CMM that would have been captured, sent to and destroyed by use i in the baseline scenario in year y（tCH_4）
$PMM_{PJi,y}$	Post-mining CMM captured, sent to and destroyed by use i in the project activity in year y（tCH_4）
$PMM_{BLi,y}$	Post-mining CMM that would have been captured, sent to and destroyed by use i in the baseline scenario in year y（tCH_4）
GWP_{CH4}	global warming potential of CMM，21tCO_2e/tCH_4

The applied ACM0008 has been approved and upgraded to version 07 at EB 55[77], which allows the measuring of $CMM_{PJi,y}$ and $PMM_{PJi,y}$ together or separately to ex-post determine the amount of methane that has been utilized by the project activity, i.e. $MM_{ELEC.}$

1.3 Emissions from power/heat generation replaced by project ($BE_{Use,y}$)

$$BE_{Use,y} = ED_{CBMw,y} + ED_{CBMz,y} + ED_{CPMM,y} \quad \textbf{(10)}$$

Where:

$BE_{Use,y}$	=	Total baseline emissions from the production of power or heat replaced by the project activity in year *y* (tCO_2)
$ED_{CBMw,y}$	=	Emissions from displacement of end uses by use of coal bed methane captured from wells where the mining area intersected the zone of influence in year *y* (tCO_2)
$ED_{CBMz,y}$	=	Emissions from displacement of end uses by use of coal bed methane captured from wells where the mining area intersected the zone of influence prior to year *y* (tCO_2)

77 http://cdm.unfccc.int/EB/archives/meetings_10.html#55

$ED_{CPMM,y}$ = Emissions from displacement of end uses by use of coal mine methane, VAM and post-mining methane (tCO_2)

And:

$$ED_{CPMM,y} = \frac{CMM_{PJ,y} + PMM_{PJ,y} + VAM_{PJ,y}}{CBMM_{tot,y}} \times PBE_{Use,y} \quad \textbf{(11)}$$

Where:

$ED_{CPMM,y}$ = Emissions from displacement of end uses by use of coal mine methane and post-mining methane (tCO_2e)

$CMM_{PJ,y}$ = Pre-mining CMM captured by the project activity in year *y* (tCH_4)

$PMM_{PJ,y}$ = Post-mining CMM captured by the project activity in year *y* (tCH_4)

$VAM_{PJ,y}$ = VAM captured by the project activity in year *y* (tCH_4)

$CBMM_{tot,y}$ = Total CBM CMM and VAM captured and utilised by the project activity in year *y* (tCH_4)

$PBE_{Use,y}$ = Potential total baseline emissions from the production of power or heat replaced by the project activity in year *y* (tCO_2e)

The electricity generated by this project will displace the equivalent electricity purchased from North China Power Grid (waste heat recovery and supply to local residents is not included in the calculation). There is no heat supply component in the emissions reduction calculation.

$$PBE_{Use,y} = GEN_{,y} \text{ x } EF_{ELEC} + HEAT_y \text{ x } EF_{HEAT} + VFUEL_y \text{ x } EF_V \quad \textbf{(12)}$$

Where:

$PBE_{Use,y}$ = Potential total baseline emissions from the production of power or heat replaced by the project activity in year *y* (tCO_2e)

GEN_y = Electricity generated by project activity in year *y* (MWh)

EF_{ELEC} = Emissions factor of electricity (grid, captive or a combination) replaced by project (tCO_2/MWh)

$HEAT_y$ = Heat generation by project activity in year *y* (GJ), including through the use of CBM

EF_{HEAT} = Emissions factor for heat production replaced by project activity (tCO_2/GJ)

$VFUEL_y$ = Vehicle fuel provided by the project activity in year *y* (GJ), including through the use of CBM

EF_V = Emissions factor for vehicle operation replaced by project activity (tCO_2/GJ)

As the project activity will replace the electricity from the North China Power Grid and CBM utilization is not included in the project activity, the formula for the total baseline emissions from the production of the power replaced by the project activity is reduced to:

$$BE_{Use,y} = GEN_y * EF_{ELEC} \quad \textbf{(13)}$$

Where:

$BE_{Use,y}$	Total baseline emissions from the production of power or heat replaced by the project activity in year y (tCO_2e)
GEN_y	Electricity generated by the project activity in year y（MWh）
EF_{ELEC}	Emission factor of the North China Power Grid（tCO_2e/MWh）

1.3.1 Emission factor of power grid (EF_{ELEC})

Sub step 1. Identify the relevant electricity systems

In accordance with the *Tool to Calculate the Emission Factor for an Electricity System*, the project electricity system of the Project is identified according to the delineation of the project electricity system and connected electricity systems published by China's DNA.

According to the *2010 Baseline Emission Factors for Regional Power Grids in China* issued by China's DNA which provides the delineation of relevant electric power systems, North China Power Grid is the relevant electric power system of the Project. North China Power Grid is composed of Shandong, Shanxi, Beijing, Tianjin, Hebei, Inner Mongolia provincial grids.

Sub step 2. Choose whether to include off-grid power plants in the project electricity system (optional)

In accordance with the *Tool to Calculate the Emission Factor for an Electricity System*, project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

Option I: Only grid power plants are included in the calculation.

Option II: Both grid power plants and off-grid power plants are included in the calculation.

The project participants choose Option I: Only grid power plants are included in the calculation as the way to calculate the operating margin and build margin emission factors.

Sub step 3. Select a method to determine the operating margin (OM)

The Operating Margin emission factor ($EF_{OM,y}$) is calculated based on one of the four following methods:

- Simple OM;
- Simple adjusted OM;
- Dispatch data analysis OM;
- Average OM.

'Simple OM' (1) method is applicable to this project activity as in the last five years the low cost/must run resources had constituted less than 50% of generation in the project power grid, the North China Power Grid. The data in the table below illustrates this point.

Table B.6-1 Power generation mix of North China Power Grid for most recent five years

Energy Source	2004	2005	2006	2007	2008
Total Power Generation (GWh)	530,804	607,782	609,971	847,500	716,694

Total Low-cost/must run resources[78] (GWh)	4032	4551	4804	7640	9110
Percentage of Low cost/must run resources% of the total grid generation (GWh)	0.8	0.7	0.8	0.9	1.3
Data Source*	2005 (p.474)	2006 (p.568)	2007 (p.638)	2008 (p.733)	2009 (p.716)

*Data Sources: '*China Electric Power Yearbook (2005-2009)' issued by the Chinese National Statistics Bureau*

The emission factors were determined ex ante (A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation) and will not be updated during the first crediting period.

Sub step 4. Calculate the operating margin emission factor according to the selected method

Three options are provided in the *Tool to Calculate the Emission Factor for an Electricity System* for the determination of the simple OM emission factor ($EF_{grid,OMsimple,y}$). Since 1) the data on net electricity generation and a CO_2 emission factor of each power unit in North China Power Grid are not available; 2) only nuclear and renewable power generation are considered as low-cost/must-run power sources, and the quantity of electricity supplied to the grid by these sources is known; and 3) Off-grid power plants are not included in the calculation, Option B (based ondata on the total net electricity generation of all power plants / units serving the system and the fuel types and total fuel consumption of the project electricity system) is adopted to calculate the simple OM emission factor ($EF_{grid,OMsimple,y}$). The formula of $EF_{grid,OMsimple,y}$ calculation is

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_y} \quad \textbf{(14)}$$

Where:

$EF_{grid,OMsimple,y}$	is the simple operating margin CO2 emission factor in year y in tCO2/MWh;
$FC_{i,y}$	is the amount of fossil fuel type i consumed in the project electricity system in year y in mass or volume unit;
$NCV_{i,y}$	is the net calorific value (energy content) of fossil fuel type i in year y in GJ/mass or volume unit;
$EF_{CO2,i,y}$	is the CO2 emission factor of fossil fuel type i in year y in tCO2/GJ;
EG_y	is the net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year y in MWh;
i	are all fossil fuel types combusted in power sources in the project electricity system in year y;
y	is the relevant year as per the data vintage chosen in Step 3.

With reference to the *2010 Baseline Emission Factors for Regional Power Grids in China*, the simple OM

[78] *Note: Only nuclear/renewables are considered low-cost/must-run*

emission factor ($EF_{grid,OM,y}$) of North China Power Grid is 0.9914 tCO_2e/MWh (see Annex 3 for details).

Sub step 5. Identify the group of power units to be included in the build margin

The sample group of power units used to calculate the build margin consists of either:

(a) The set of five power units that have been built most recently, or

(b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

Due to data availability, the latest clarification from CDM EB is applied. And option (b) is used to calculate build margin. In terms of vintage of data, there are also two options:

Option 1. For the first crediting period, calculate the build margin emission factor *ex-ante* based on the most recent information available on units already built for sample group *m* at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Option 2. For the first crediting period, the build margin emission factor shall be updated annually, *ex-post*, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated *ex-ante*, as described in option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

Option 1 is used for the proposed project.

Sub step 6. Calculate the build margin emission factor

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \qquad \textbf{(15)}$$

Where:

$EF_{grid,BM,y}$	is the build margin CO_2 emission factor in year y in tCO_2/MWh;
$EG_{m,y}$	is the net quantity of electricity generated and delivered to the grid by power unit m in year y in MWh;
$EF_{EL,m,y}$	is the CO2 emission factor of power unit m in year y in tCO_2/MWh;
m	is the power units included in the build margin;
y	is the most recent historical year for which power generation data are available.

Since there is no way to separate the different generation technology capacities as fuel coal, fuel oil, fuel gas etc from thermal power based on the present statistical data, the following calculating measures will be taken: First, according to the energy statistical data of most recent one year, determine the ratio of CO_2 emissions produced by solid, liquid, and gas fuel consumption for power generation; then multiply this

ratio by the respective emission factors based on commercially available best practice technology in terms of efficiency. Finally, this emission factor for thermal power is multiplied with the ratio of thermal power identified within the approximation for the latest 20% installed capacity addition to the grid. The result is the BM emission factor of the grid.

Step a. Calculate the power generation emissions for solid, liquid and gas fuel and each share of total emissions based on the *Energy Balance Table* of the most recent year.

$$\lambda_{Coal,y} = \frac{\sum_{i \in COAL,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \quad \textbf{(16)}$$

$$\lambda_{Oil,y} = \frac{\sum_{i \in OIL,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \quad \textbf{(17)}$$

$$\lambda_{Gas,y} = \frac{\sum_{i \in GAS,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \quad \textbf{(18)}$$

Where:

$FC_{i,j,y}$ is the amount of fuel i consumed by power plant /unit j in year(s) y in mass or volume unit;

$NCV_{i,y}$ is the net calorific value (energy content) of fossil fuel type i in year y in GJ/mass or volume unit;

$EF_{CO2,i,y}$ is the CO_2 emission factor of fossil fuel type i in year y in tCO_2/GJ.

COAL, OIL and GAS are footnote group for solid fuels, liquid fuels and gas fuels.

Step b. Calculate emission factor for thermal power of each grid based on the result of Step a. and the efficiency level of the best technology commercially available in China.

$$EF_{Thermal} = \lambda_{Coal,y} \times EF_{Coal,Adv,y} + \lambda_{Oil,y} \times EF_{Coal,Adv,y} + \lambda_{Gas,y} \times EF_{Gas,Adv,y} \quad \textbf{(19)}$$

Where:

$EF_{Coal,Adv,y}$, $EF_{Oil,,Adv,y}$ and $EF_{Gas,Adv,y}$ represents the efficiency level of the best coal-fired, oil-based and gas-based power generation technology commercially available in China.

Step c. Calculate BM of the grid based on the result of Step b and the share of thermal power of recent 20% capacity additions.

$$EF_{grid,BM,y} = \frac{CAP_{Thermal,y}}{CAP_{Total,y}} \times EF_{Thermal,y} \quad \textbf{(20)}$$

Where:

$CAP_{Total,y}$ Total capacity additions while $CAP_{Thermal,y}$ is capacity additions of thermal power.

With reference to the *Notification on Determining Baseline Emission Factor of China's Grid in 2010*, which uses three years of data from 2007-2009, the Build Margin emission factor ($EF_{BM,y}$) of the NCPG is 0.7495t CO_2e/MWh.
As mentioned above, the build margin emission factor of the baseline is calculated ex-ante and will not be renewed in the first crediting period.

***Sub step 7.* Calculate the combined margin emissions factor (EF_y)**

The baseline emission factor EF_y is calculated as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$), where the weights $\omega_{OM,y}$ and $\omega_{BM,y}$ by default, are 50% (i.e., $\omega_{OM,y} = \omega_{BM,y} = 0.5$) in the first crediting period, and $EF_{OM,y}$ and $EF_{BM,y}$ are calculated as described above and are expressed in tCO_2/MWh.

$$EF_y = \omega_{OM} \times EF_{grid,OM,y} + \omega_{BM} \times EF_{grid,BM,y} \quad (19)$$

2. Project emissions （PE_y）
Project emissions are defined by the following equation

$$PE_y = PE_{ME} + PE_{MD} + PE_{UM} \quad \textbf{(21)}$$

Where:

PE_y: Project emissions in year y (tCO_2e)

PE_{ME} : Project emissions from energy use to capture and use methane (tCO_2e)

PE_{MD} : Project emissions from methane destroyed (tCO_2e)

PE_{UM} : Project emissions from un-combusted methane (tCO_2e)

2.1 Combustion emissions from additional energy required for CMM capture and use （ PE_{ME} ）

Additional energy may be used for the capture, transport, compression and use or destruction of CMM extracted from the Yuecheng coal mine. Emissions from this energy use should be included as project emissions.

$$PE_{ME} = CONS_{ELEC,PJ} \cdot CEF_{ELEC} + CONS_{HEAT,PJ} \cdot CEF_{HEAT} + CONS_{FossFuel,PJ} \cdot CEF_{FossFuel} + PE_{FC,j,y} \quad \textbf{(22)}$$

Where:

PE_{ME}	=	Project emissions from energy use to capture and use or destroy methane (tCO_2e)
$CONS_{ELEC,PJ}$	=	Additional electricity consumption for capture and use or destruction of methane, if any (MWh)

CEF_{ELEC} = Carbon emissions factor of electricity used by coal mine (tCO_2/MWh)
$CONS_{HEAT,PJ}$ = Additional heat consumption for capture and use or destruction of methane, if any (GJ)
CEF_{HEAT} = Carbon emissions factor of heat used by coal mine (tCO_2e/GJ)
$CONS_{FossFuel,PJ}$ = Additional fossil fuel consumption for capture and use or destruction of methane, if any (GJ)
$CEF_{FossFuel}$ = Carbon emissions factor of fossil fuel used by coal mine (tCO_2/GJ)
$PE_{FC,j,y}$ = CO_2 emissions from fossil fuel combustion in process j during the year *y*. Calculated using the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"

With regard to the project activity, the methane used by this project is captured and vented in the baseline scenario. No additional fuel is used in capturing methane although some electricity is consumed. Therefore, the formula is reduced to:

$$PE_{ME} = CONS_{ELEC,PJ} \cdot CEF_{ELEC} \quad \textbf{(23)}$$

Where:

PE_{ME}: Project emissions from energy use to capture and use methane (tCO_2e);

$CONS_{ELEC,PJ}$: Additional electricity consumption for power generation by using of methane (MWh);

CEF_{ELEC}: CO_2 emission factor of the North China Power Grid(tCO_2e/MWh).

2.2 Combustion emissions from use of captured methane (*PE_{MD}*)

The captured methane is used for power generation in this project. When the captured methane is burned in the engine, combustion emissions are released. In addition, if NMHC accounts for more than 1% by volume of the extracted coal mine gas, combustion emissions from these gases should also be included.

$$PE_{MD} = (MD_{FL} + MD_{OX} + MD_{ELEC} + MD_{HEAT} + MD_{GAS}) \times (CEF_{CH4} + r \times CEF_{NMHC}) \quad \textbf{(24)}$$

With:

$$r = PC_{NMHC} / PC_{CH4} \quad \textbf{(25)}$$

Where:

PE_{MD} = Project emissions from CMM/CBM destroyed (tCO_2e)
MD_{FL} = Methane destroyed through flaring (tCH_4)
MD_{OX} = Methane destroyed through flameless oxidation (tCH_4)
MD_{ELEC} = Methane destroyed through power generation (tCH_4)
MD_{HEAT} = Methane destroyed through heat generation (tCH_4)
MD_{GAS} = Methane destroyed after being supplied to gas grid or for vehicle use (tCH_4)
CEF_{CH4} = Carbon emission factor for combusted methane (2.75 tCO_2/tCH_4)
CEF_{NMHC} = Carbon emission factor for combusted non methane hydrocarbons (the concentration varies and, therefore, to be obtained through periodical analysis of captured methane) ($tCO_2/tNMHC$)

r	=	Relative proportion of NMHC compared to methane
PC_{CH4}	=	Concentration (in mass) of methane in extracted gas (%), measured on wet basis
PC_{NMHC}	=	NMHC concentration (in mass) in extracted gas (%)

According to ACM0008, combustion emissions from NMHC should also be included if they account for more than 1% by volume of the extracted coal mine gas. However, NMHC concentration at Yuecheng coal mine is below this threshold. Therefore, PC_{NMHC} =0, and thus r=0. To remain in compliance with the methodology NMHC concentrations will be monitored throughout the crediting period.

In each end-use, the amount of gas destroyed depends on the efficiency of combustion of each end use.

$$MD_{FL} = MM_{FL} - (PE_{flare}/GWP_{CH4}) \quad \textbf{(26)}$$

Where:

MD_{FL}	=	Methane destroyed through flaring (tCH_4)
MM_{FL}	=	Methane measured sent to flare (tCH_4)
PE_{flare}	=	Project emissions of non-combusted CH_4, expressed in terms of CO_{2e}, from flaring of the residual gas stream (tCO_2e)
GWP_{CH4}	=	Global warming potential of methane (21 tCO_2e/tCH_4)

The project emissions of non-combusted CH_4 expressed in terms of CO_{2e} from flaring of the residual gas stream (PE_{flare}) shall be calculated following the procedures described in the "Tool to determine project emissions from flaring gases containing methane". PE_{flare} can be calculated on an annual basis or for the required period of time using this tool.

As the project does not involve flameless oxidation or the usage of VAM, the following calculations **(27)-(32)** given in the methodology are not relevant to the proposed project.

$$MD_{OX} = MM_{OX} - PE_{OX} \quad \textbf{(27)}$$

Where:

MD_{OX}	=	Methane destroyed through flameless oxidation (tCH_4)
MM_{OX}	=	Methane measured sent to flameless oxidizer (tCH_4)
PE_{OX}	=	Project emissions of non oxidized CH_4 from flameless oxidation of the VAM stream (tCH_4)

And where:

$$MM_{OX} = VAM_{flow.rate,y} \cdot time_y \cdot PC_{CH4.VAM} \cdot D_{CH4,corr\ inflow} \quad \textbf{(28)}$$

Where:

$VAM_{flow.rate,y}$	=	Average flow rate of VAM entering the flameless oxidation unit during period *y* (m^3/s)
$time_y$	=	Time during which VAM unit is operational during period y (s)
$PC_{CH4.VAM}$	=	Concentration of methane in the VAM entering the flameless oxidation unit (m^3/m^3)
$D_{CH4,corr\ inflow}$	=	Density of methane entering the flameless oxidation unit corrected for pressure

and temperature ($P_{VAMinflow}$ and $T_{VAMinflow}$ respectively) (tCH_4/m^3)

and

$PE_{OX} = VAM_{flow.rate,y} \cdot time_y \cdot PC_{CH4.exhaust} \cdot D_{CH4,corr\ exh}$ **(29)**

Where:
$PC_{CH4exhaust}$ = Concentration of methane in the VAM exhaust (m^3/m^3)
$D_{CH4,corr\ exh}$ = Density of methane corrected for pressure and temperature in the exhaust gases ($P_{VAMexhaust}$ and $T_{VAMexhaust}$ respectively) (tCH_4/m^3)

For *ex ante* projections, the efficiency of destruction of methane in the VAM may be assumed to be 90%.

$MD_{ELEC} = MM_{ELEC} \times Eff_{ELEC}$ **(30)**

Where:
MD_{ELEC} = Methane destroyed through power generation (tCH_4)
MM_{ELEC} = Methane measured sent to power plant (tCH_4)
Eff_{ELEC} = Efficiency of methane destruction/oxidation in power plant (taken as 99.5% from IPCC)

$MD_{HEAT} = MM_{HEAT} \times Eff_{HEAT}$ **(30)**

Where:
MD_{HEAT} = Methane destroyed through heat generation (tCH_4)
MM_{HEAT} = Methane measured sent to heat plant (tCH_4)
Eff_{HEAT} = Efficiency of methane destruction/oxidation in heat plant (taken as 99.5% from IPCC)

$MD_{GAS} = MM_{GAS} \times Eff_{GAS}$ **(31)**

Where:
MD_{GAS} = Methane destroyed after being supplied to gas grid (tCH_4)
MM_{GAS} = Methane measured supplied to gas grid for vehicle use or heat/power generation off-site (tCH_4)
Eff_{GAS} = Overall efficiency of methane destruction/oxidation through gas grid to various combustion end uses, combining fugitive emissions from the gas grid and combustion efficiency at end user (taken as 98.5% from IPCC)

With regard to the project activity, the formula is reduced to:

$PE_{MD}=MD_{ELEC} \cdot CEF_{CH4}$ **(32)**

Where:
PE_{MD}: Project emission from CMM/CBM destroyed（tCO_2e）；
MD_{ELEC}: Methane destroyed through power generation（tCH_4）；

CEF_{CH4}:	Carbon emission factor for combusted methane ($2.75tCO_2e/tCH_4$)；

2.3 Un-combusted methane from end uses (*PE_{UM}*)

Not all of the methane used to generate power and heat will be combusted, so a small amount will escape to the atmosphere. These emissions are calculated using the following:

$$PE_{UM} = [GWP_{CH4} \times \sum_i MM_i \times (1 - Eff_i)] + PE_{flare} + PE_{OX} \times GWP_{CH4} \quad \textbf{(33)}$$

Where:

PE_{UM}	=	Project emissions from un-combusted methane (tCO_2e)
GWP_{CH4}	=	Global warming potential of methane (21 tCO_2e/tCH_4)
i	=	Use of methane (power generation, heat generation, supply to gas grid to various combustion end uses)
MM_i	=	Methane measured sent to use i (tCH_4)
Eff_i	=	Efficiency of methane destruction in use i (%)
PE_{flare}	=	Project emissions of non-combusted CH_4 expressed in terms of CO_2e from flaring of the residual gas stream (tCO_2e)
PE_{OX}	=	Project emissions of non oxidized CH_4 from flameless oxidation of the VAM stream (tCH_4)

With regarded the project activity, the formula is reduced to:

$$PE_{UM}= GWP_{CH4}\cdot (MM_{ELEC}\cdot(1-Eff_{ELEC})) \quad (34)$$

Where:

PE_{UM} :	Project emission from un-combusted methane (tCO_2e);
GWP_{CH4}:	Global warming potential of methane ($21tCO_2e/tCH_4$);
MM_{ELEC}:	Methane measured sent to power plant (tCH_4); and
Eff_{ELEC}:	Efficiency of methane destruction/oxidation in power plant (taken as 99.5% from IPCC).

As the project undergoes a period of trail operation (80% of operation capacity) for the first year, less CMM is supplied to the power plant and thus there are less emissions from un-combusted methane in the first year of operation. .

3. Leakage

The formula for leakage is given as follows:

$$LE_y=LE_{d,y}+LE_{o,y} \quad \textbf{(35)}$$

Where:

LE_y: Leakage emissions in year y (tCO_2e)

$LE_{d,y}$: Leakage emissions due to displacement of other baseline thermal energy uses of methane in year y (tCO_2e);

$LE_{o,y}$: Leakage emissions due to other uncertainties in year y (tCO_2e).

3.1 *Displacement of baseline thermal energy uses*

Leakage may occur if the project activity prevents CMM from being used to meet baseline thermal energy demand, whether as a result of physical constraints on delivery, or price changes. Where regulations require that local thermal demand is met before all other uses, which is common in many jurisdictions, then this leakage can be ignored.

If displacement does occur, the project activity may cause increased emissions outside the project boundary associated with meeting thermal energy demand with other fuels. Because of likely day-to-day fluctuations in CMM extraction rates, to ensure a conservative result, CERs should not be calculated solely from annual data. Any CERs generated from methane destruction should be calculated using daily logs, or monthly logs if daily data is not available, of project-case demand for CMM for non-thermal uses compared against estimates of baseline CMM demand for thermal uses. For each day (or month) of the crediting period, this form of leakage must be calculated if:

$$ME_k - (MM_{ELEC,k} + MM_{HEAT,k}) < TH_k \quad \textbf{(36)}$$

With:

$$TH_k = \frac{\overline{TH_{BL}}}{365} \times d_k^{\max} \quad \textbf{(37)}$$

Where:

ME_k = Methane extracted on day k (tCH_4)

$MM_{ELEC,k}$ = Methane measured sent to power plant on day k (tCH_4)

$MM_{HEAT,k}$ = Methane measured sent to new heat generation uses on day k in the Project Scenario that would not have been sent in the Baseline Scenario on day k (tCH_4)

TH_k = Methane used to serve thermal energy demand in the baseline for day k (tCH_4)

TH_{BL} = Average annual thermal demand over the past 5 years (tCH_4)

d_k = Scalar adjustment factor for day k to reflect seasonal variations such that $\Sigma d_k=365$

$d_k^{\max}$ = Maximum scalar adjustment factor for day k over the past 5 years (i.e. $\Sigma d^{\max}_k>365$)

Under this condition, some portion of CMM/VAM that would have gone to meet thermal energy demand in the baseline scenario is instead used by the project. A corresponding amount of thermal energy demand in the project scenario will have to be met by an alternative fuel, leading to a possible increase in emissions. To calculate these emissions, the following approach should be used.

The amount of thermal energy from CMM/VAM diverted from thermal uses existing in the baseline diverted to other uses by the project should be calculated on a daily basis, and then summed up for each year y:

$$ED_{th,y} = \Sigma(ED_{th,k}) = \Sigma[\max(0, (TH_k - (ME_k - (MM_{ELEC,k} + MM_{HEAT,k}))) \text{ x } NCV_{CH4}] \quad \textbf{(38)}$$

Where:

$ED_{th,y}$	=	Quantity of thermal energy displaced by the project activity in year *y* (GJ)
$ED_{th,k}$	=	Quantity of thermal energy displaced by the project activity on day *k* (GJ)
ME_k	=	Total methane extracted on day *k* (tCH_4)
$MM_{ELEC,k}$	=	Methane measured sent to power plant on day *k*(tCH_4)
$MM_{HEAT,k}$	=	Methane measured sent to new heat generation uses on day k in the Project Scenario that would not have been sent in the Baseline Scenario on day *k* (tCH_4)
NCV_{CH4}	=	Net calorific value for methane(GJ/tCH_4)

Project participants must describe and justify what alternative fuel(s) is (are) used to provide thermal energy in the area when VAM/CMM is not available. They must then calculate the amount of alternative fuel required to provide the same heat output as the VAM/CMM.

$$Q_{AF,y} = ED_{th,y} / NCV_{AF} \quad \textbf{(39)}$$

Where:

$Q_{AF,y}$	=	Quantity of alternative fuels displaced by the project activity in year *y* (tonnes or m^3)
$ED_{th,y}$	=	Quantity of thermal energy displaced by the project activity in year *y* (GJ)
NCV_{AF}	=	Net calorific value for alternative fuels (GJ/tonne or m_3)

Emissions from the use of alternative fuels are calculated as follows:

$$LE_{d,y} = Q_{AF,y} \text{ x } NCV_{AF} \text{ x } EF_{AF} \text{ x } OXID \quad \textbf{(40)}$$

Where:

$LE_{d,y}$	=	Leakage emissions in year *y* (tCO_2e)
$Q_{AF,y}$	=	Quantity of alternative fuels displaced by the project activity in year *y* (tonnes or m^3)
NCV_{AF}	=	Net calorific value for alternative fuels (GJ/tonne or m_3)
EF_{AF}	=	Emissions factor for alternative fuel (tCO_2/GJ), sourced from IPCC
OXID	=	Oxidation efficiency of combustion (%), sourced from IPCC

The thermal energy uses in the baseline scenario is outside the project boundary, and the proposed project is not supposed to displace baseline thermal energy uses at any time during the crediting period there are no leakages from this source. So $LE_{d,y}$=0

<u>3.2 CBM drainage from outside the de-stressed zone</u>

Surface CBM drainage wells can in some cases drain gas from seams that are outside the de-stressed zone for 140m specified in this methodology, or could extract from an area larger than the circular zone of influence used in this methodology. The vertical leakage would only occur if the surface wells are not cased. Similarly, if there is surface CBM extraction in the baseline, then the gas drawn from other seams would be the same in the baseline and project scenario. Therefore, in cases where:

(1) Surface boreholes drilled in the project activity are not cased;

(2) There are no surface boreholes for CBM draining present in the baseline scenario.

Project participants should discount the total emission reductions achieved. The amount of discount should be based on:

Option 1: A comparison of *ex ante* engineering estimates of CBM production from surface boreholes versus actual project activity CBM production;

Option 2: A standard discount factor of 10%.

There is no CBM drainage involved in the project activity.

3.3 Impact of CDM project activity on coal production

The additional CBM/CMM extraction from the CDM project activity could in some cases release certain constraints that currently limit mining operations. In cases of gassy mines where production is constrained by gas drainage capacity (i.e. too high concentration requires temporary interruption of mining operation) the CER value can cover both the cost of CMM/CBM destruction and increase of extraction capacity to release the concentration constraint, then allowing increased coal production. This will only be the case, however, when no CBM/CMM extraction is present in the baseline scenario (i.e. the baseline scenario is ventilation of mine gas only).

If the project activity is CBM/CMM extraction and the baseline scenario is ventilation only, project participants should:

Option 1: Calculate the extra coal production likely by the relaxing of the production constraint. The emission reductions claimed by the project should then be discounted so that CBM/CMM capture from the additional coal production is not included;

Option 2: Apply a standard discount factor of 10%. Note that for projects using CBM this leakage is to be calculated in addition to leakage described in section "CBM drainage from outside the de-stressed zone" above.

No impact from the project activity on coal production is considered, as CMM drainage is already a part of the baseline scenario the treatment in the baseline is not only ventilation but also use by nearby residents and usage as support fuel for heating for mining operations on site and at related party mine sites. Therefore leakage from this source is zero.

3.4 Impact of CDM project activity on coal prices and market dynamics

Depending on relative market price of coal and the value of CERs for the CDM project activity, the new carbon revenue could theoretically eventually induce a decrease in coal prices and, as a result, lead to an increase of coal demand (i.e. a rebound effect). The share of coal in national energy demand could therefore increase, leading to higher emissions that could offset emission reduction achieved through CMM/CBM destruction.

While this impact is theoretically possible, reliable scientific information is not currently available to assess this risk and check if the phenomenon would be negligible or not. Moreover, it is difficult to assess *ex ante* the contribution of any particular project given the dynamic nature of local and global coal markets.

According to ACM0008 leakage from this part is considered zero, until the EB provides new instructions.

Above on, the total leakage of the project is LE_y=0.

B.6.2. Data and parameters that are available at validation:

Many parameters listed in the methodology are related only to thermal or mechanical processes not involved in the project activity, or the utilization of CBM or VAM, neither of which is related to the project activity. To avoid confusion, parameters not used in the calculation of the emissions reductions of the proposed project have not been included in the table below.

Data / Parameter:	CEF_{CH4}
Data unit:	tCO_2e/tCH_4
Description:	Carbon emission factor for combusted methane
Source of data used:	Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Volume 2Energy, Table 1.3 and 1.4, page 1.21-1.24, chapter 1. No country specific data is available.
Value applied:	2.75
Justification of the choice of data or description of measurement methods and procedures actually applied:	IPCC default value
Any comment:	Low uncertainty

Data / Parameter:	GWP_{CH4}
Data unit:	tCO_2e/tCH_4
Description:	Global warming potential of methane
Source of data used:	Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Volume 2Energy, Table 1.3 and 1.4, page 1.21-1.24, chapter 1. No country specific data is available.
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied:	IPCC default value
Any comment:	Low uncertainty

Data / Parameter:	Installed capacity
Data unit:	kW
Description:	Installed capacity of provincial sub-grids in the North China Power Grid
Source of data used:	China Electric Power Yearbook 2005-2009
Value applied:	As per Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied:	Authoritative national publications

Any comment:	Low uncertainty

Data / Parameter:	$EF_{Coal,Adv,y}$
Data unit:	%
Description:	Electricity supply efficiency of the best commercially available technology for coal-fired power generation in China.
Source of data used:	Chinese DNA: Bulletin on China's Regional Grid Baseline Emission Factor 2010
Value applied:	39.08%
Justification of the choice of data or description of measurement methods and procedures actually applied:	Bulletin on China's Regional Grid Baseline Emission Factor 2010
Any comment:	Low uncertainty

Data / Parameter:	$EF_{Gas,Adv,y}$
Data unit:	%
Description:	Electricity supply efficiency of the best commercially available technology for gas-fired power generation in China.
Source of data used:	Chinese DNA: Bulletin on China's Regional Grid Baseline Emission Factor 2010
Value applied:	51.46%
Justification of the choice of data or description of measurement methods and procedures actually applied:	Bulletin on China's Regional Grid Baseline Emission Factor 2010
Any comment:	Low uncertainty

Data / Parameter:	$EF_{Oil,Adv,y}$
Data unit:	%
Description:	Electricity supply efficiency of the best commercially available technology for oil-fired power generation in China.
Source of data used:	Chinese DNA: Bulletin on China's Regional Grid Baseline Emission Factor 2010
Value applied:	51.46%
Justification of the choice of data or description of measurement methods and procedures actually applied:	Bulletin on China's Regional Grid Baseline Emission Factor 2010
Any comment:	Low uncertainty

Data / Parameter:	$CAP_{Thermal,y}$
Data unit:	MW

Description:	The newly added thermal power capacity in the project electricity system, NCPG, in year *y*
Source of data used:	China Electric Power Yearbook 2007-2009
Value applied:	See annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied:	Official publication. Publicly accessible and reliable data source.
Any comment:	Low uncertainty

Data / Parameter:	$CAP_{Total,y}$
Data unit:	MW
Description:	The total newly added capacity in the project electricity system, NCPG, in year *y*
Source of data used:	China Electric Power Yearbook 2007-2009
Value applied:	See annex 3 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied:	Official publication. Publicly accessible and reliable data source.
Any comment:	Low uncertainty

Data / Parameter:	NCV_i
Data unit:	GJ/t or m^3
Description:	Net calorific value of fuel *i*
Source of data used:	China Energy Statistical Yearbook（2007-2009）
Value applied:	As per Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied:	Authoritative national publications
Any comment:	Low uncertainty

Data / Parameter:	$F_{i,j,y}$
Data unit:	t or m^3
Description:	The amount of fuel i (in a mass or volume unit) consumed by relevant provincial sub-grid j in year y.
Source of data used:	China Energy Statistical Yearbook（2005-2009）
Value applied:	As per Annex 3
Justification of the choice of data or description of	Authoritative national publications

measurement methods and procedures actually applied:	
Any comment:	Low uncertainty

Data / Parameter:	EF_i
Data unit:	tC/TJ
Description:	The carbon emission factor per unit of energy of the fuel i
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories: Volume 2Energy, Table 1.3 and 1.4, page 1.21-1.24, chapter 1.
Value applied:	As per Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied:	IPCC default value
Any comment:	Low uncertainty

Data / Parameter:	Eff_{ELEC}
Data unit:	%
Description:	Efficiency of methane destruction / oxidation in power plant
Source of data used:	ACM0008 (Version 7)
Value applied:	99.5%
Justification of the choice of data or description of measurement methods and procedures actually applied:	ACM0008 (Version 7) specifies this value to be applied.
Any comment:	Low uncertainty

Data / Parameter:	$EF_{CM,grid,y}$
Data unit:	tCO_2e/MWh
Description:	CO_2 emission factor of the NCPG
Source of data used:	Calculated
Value applied:	0.87045
Justification of the choice of data or description of measurement methods and procedures actually applied:	Calculated as per "Tool to calculate the emission factor for an electricity system" in Section B.6.3.
Any comment:	Low uncertainty

Data / Parameter:	$EF_{OM,grid,y}$
Data unit:	tCO_2e/MWh
Description:	CO_2 operating margin emission factor of the NCPG
Source of data used:	Published information from the Chinese DNA

	Available at: http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2552.pdf
Value applied:	0.9914
Justification of the choice of data or description of measurement methods and procedures actually applied:	Calculated as per "Tool to calculate the emission factor for an electricity system". See annex 3 for details.
Any comment:	Low uncertainty

Data / Parameter:	$EF_{BM,grid,y}$
Data unit:	tCO_2e/MWh
Description:	CO_2 build margin emission factor of the NCPG
Source of data used:	Published information from the Chinese DNA Available at: http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2552.pdf
Value applied:	0.7495
Justification of the choice of data or description of measurement methods and procedures actually applied:	Calculated as per "Tool to calculate the emission factor for an electricity system". See annex 3 for details.
Any comment:	Low uncertainty

Data / Parameter:	D_{CH4}
Data unit:	tCH_4/m^3CH_4
Description:	Density of methane
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	0.00067
Justification of the choice of data or description of measurement methods and procedures actually applied:	Actual density will be measured onsite.
Any comment:	Low uncertainty

B.6.3 Ex-ante calculation of emission reductions:

>>

Some basic data used in calculating baseline and project emission is listed in table B.6-1

Table B.6-2 Basic data for the estimation of emission reductions

Data	Value	Source
Annual methane consumption by power generation plant (m^3)	109,710,000	Section 7.7 of FSR (p.51)
Methane concentration (%)	35	CMM component analysis report" issued by Jincheng City Gas Testing centre on 23 Dec

		2009 (this report was made according to the GB/T13610-2003 standard)
Methane density under normal conditions (tCH_4/m^3CH_4)	0.00067	2006 IPCC Guidelines for National Greenhouse Gas Inventories
The amount of methane consumed by the power station in one year (tCH_4)	25,727	MM_{ELEC} = 109,710,000 m^3 CH_4 × 35% × 0.00067 tCH_4/m^3CH_4 = 25,727 tCH_4
Power generated by the project (net of auxiliary consumption) in year y (MWh)	103,680	Section 1.2 of FSR (p.3)
Captive power consumption rate of the proposed project of the Total power generation	10%	Section 7.1 of FSR (p.49)
Installed capacity (MW)	20MW	Section 1.2 of FSR (p.3)
Numbers of engines	20	Section 1.2 of FSR (p.3)
Power generation efficiency	80%	Section 1.2.5 of FSR (p.3)

1. Estimated baseline emissions

1.1 Methane destruction in the baseline ($BE_{MD,y}$)

In the baseline scenario in the project boundary all the drained gas is vented without any utilization. Thus,

$BE_{MD,y}$ =0.

1.2 Methane released into the atmosphere ($BE_{MR,y}$)

All the methane captured is vented in the baseline scenario.

$BE_{MR,y} = GWP_{CH4} \times MM_{ELEC}$ = 21tCO_2e/tCH_4× 25,727tCH_4/year

= 540,267 tCO_2e/year

1.3 Emissions from power/heat generation replaced by project ($BE_{Use,y}$)

GEN_y = 103,680MWh

GEN_y is the power generated by the project (net of auxiliary consumption) in year y (MWh)

As the project is intended to operate continuously, the FSR (p.11) assumes generators will be run at 80% of their rated capacity. This operational efficiency is made on the basis of manufacturer recommendations for the continuous operation of power generation equipment[79].

However, it is likely that observed generator efficiency could be lower than this due to the altitude of the project site. Given the co-ordinates of the project site, Google Earth estimates the altitude to be 820m

[79] '*Yuecheng generator operation hour and efficiency evidence*' issued by Shandong Jichai Green Power Equipment Co. Ltd on 23[st] February 2012

(2700 feet)[80]. It is commonly accepted that higher altitudes and thinner air reduces the operating capacity of generators by up to 5% per 1000ft above sea level[81]. To be conservative, such reductions to efficiency and hence power generation have not been considered in the financial analysis.

Calculation of the Grid emission factor

Step 1. Calculate the operating margin emission factor $EF_{OM,grid,y}$

The value of $EF_{OM,grid,y}$ used in this document is 0.9914 tCO_2e/MWh from the data and calculation results published by the Chinese DNA[82].

Step 2. Calculate the build margin emission factor $EF_{BM,grid,y}$

The value of $EF_{BM,grid,y}$ used in this document is 0.7495 tCO_2e/MWh from the data and calculation results published by the Chinese DNA[83].

Step 3. Calculate the combined margin emission factor $EF_{CM,grid,y}$

$$EF_{CM,grid,y} = 0.5 \times EF_{OM,grid,y} + 0.5 \times EF_{BM,grid,y}$$
$$= 0.5 \times 0.9914 + 0.5 \times 0.7495 = 0.87045\ tCO_2e/MWh$$

Therefore, the Emissions from power generation replaced by project ($BE_{Use,y}$) is calculated as follows:

$$BE_{Use,y} = GEN_y \times EF_{CM,grid,y}$$
$$= 103{,}680\ MWh/year \times 0.87045\ tCO_2e/MWh$$
$$= 90{,}248\ tCO_2e/year$$

Therefore, baseline emission:

$$BE_y = BE_{MD,y} + BE_{MR,y} + BE_{Use,y} = 540{,}267 + 90{,}248 = 630{,}515\ tCO_2e/year$$

1.4 calculation of Baseline Emission

Note that in the figures for Baseline Emissions in the Table below, operation for the first year of the project (1/12/2012 – 30/11/2013) is only 80% of capacity, leading to an adjustment in the figures for years 2012 and 2013.

Year	BE_{MD} (tCO_2e)	BE_{MR} (tCO_2e)	BE_{use} (tCO_2e)	BEy (tCO_2e)
1/12/2012 - 31/12/2012	0	36,018	6,017	42,034
2013	0	441,218	73,703	514,922
2014	0	540,267	90,248	630,515

[80] '*Altitude of Yuecheng*' Google Earth screenshot taken 17th April 2012

[81] '*Operational efficiency evidence*' produced by Diesel Service and Supply. Available at http://www.dieselserviceandsupply.com/Generator_Output_Rating.aspx

[82] http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2552.pdf

[83] http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2552.pdf

2015	0	540,267	90,248	630,515
2016	0	540,267	90,248	630,515
2017	0	540,267	90,248	630,515
2018	0	540,267	90,248	630,515
2019	0	540,267	90,248	630,515
2020	0	540,267	90,248	630,515
2021	0	540,267	90,248	630,515
1/1/2022 - 30/11/2022	0	495,245	82,727	577,972
Total	0	5,294,617	884,431	6,179,048

2. Project emissions （PE_y）

According to gas sample analysis in the proposed coalmines, the NMHC concentration is below threshold of 1%, thus the combustion emissions from non-methane hydrocarbons will be ignored. The NMHC concentration will be monitored regularly in the proposed coalmines to check whether its concentration is below 1% to determine whether NMHC combustion to be included in the project emissions.

2.1 Combustion emissions from use of captured methane (*PE_{MD}*)

$PE_{MD}=MD_{ELEC}\times CEF_{CH4} = 25,598tCH_4/year\times 2.75tCO_2e/tCH_4$

$=70,395tCO_2/year$

Methane destruction by power generation:

$MD_{ELEC}=MM_{ELEC}\times Eff_{ELEC} = 25,727tCH_4/year \times 99.5\%$

$=25,598tCH_4/year$

2.3 Un-combusted methane from end uses (*PE_{UM}*)

$PE_{UM}= GWP_{CH4}\times（MM_{ELEC}\times(1-Eff_{ELEC})）$

$=21tCO_2e/tCH_4\times 25,727tCH_4/year \times (1-99.5\%)=2,701tCO_2e/year$

2.4 Project emissions from energy use to capture and use methane (*PE_{ME}*)

$PE_{ME} = 0$

Since GEN_y is the power generated by the project (net of auxiliary consumption) in year y (MWh) which has deducted the 10% auxiliary self-usage electricity, therefore the PE_{ME} equals to 0..

2.5 Calculation of Project Emission:

In the first year 1/12/2012 – 30/11/2013 of the project activity, all the equipments are in trial operation where engines are run at 80% of normal operation level. This results in reduced project emissions. From 1/12/2013 to 30/11/2022, the project will operate under normal conditions.

Year	PE_{ME} (tCO_2e)	PE_{MD} (tCO_2e)	PE_{UM} (tCO_2e)	PE_y (tCO_2e)
1/12/2012 - 31/12/2012	0	4,693	180	4,873
2013	0	57,489	2,206	59,695
2014	0	70,395	2,701	73,096
2015	0	70,395	2,701	73,096
2016	0	70,395	2,701	73,096
2017	0	70,395	2,701	73,096
2018	0	70,395	2,701	73,096
2019	0	70,395	2,701	73,096
2020	0	70,395	2,701	73,096
2021	0	70,395	2,701	73,096
1/1/2022 - 30/11/2022	0	64,529	2,476	67,005
Total	0	689,871	26,470	716,341

3. Leakage

- There is NO existing VAM/CMM/CBM distribution system for thermal energy. The usage of CMM gas in the baseline is by 3 existing gas-fired hot water boilers[84]. Therefore a) "detailed description of the existing VAM/CMM/CBM distribution system for thermal energy" is not available;
- Yuecheng coalmine started production from 2009, therefore we only have record in 2009 (6 months), 2010 and 2011, project proponents cannot use "b) a statistical projection based on VAM/CMM/CBM availability and thermal energy VAM/CMM/CBM usage rates over at least the past five years"

Due to the reasons above, we cannot use equation "$TH_{BL,k} = \frac{TH_{BL,y}}{365} \times d_k^{\max}$" in this calculation

We are using c). "this approach should assume that thermal energy demand for VAM/CMM/CBM in all future years will be equal to the maximum amount of VAM/CMM/CBM that can be delivered"

There is no VAM/CBM extracted from the Yuecheng coalmine.

According to the specification of the WNS4 gas-fired hot water boilers[85], the gas (pure methane) consumption is: 340 cubic meters per hour. In order to be conservative, we assume the boilers are working as 24 hours per day. Therefore the maximum usage of CMM and PMM for day k is:

340 m3/hour *24 hours*3 = 24,480cubic meters pure methane per day

---

[84] gas fired hot water boilers in Yuecheng coalmine

[85] WNS4 gas-fired hot water boilers specification from the boiler supplier

Therefore, Methane used to serve estimated thermal energy demand in the baseline for day k of year y (tCH4) $TH_{BL,k}$ = 24,480 cubic meters pure methane

According ot the methodology, if $ME_k - (MM_{ELEC,k} + MM_{HEAT,k}) < TH_k$, then the leakage must be included in the calculation, however:

According to the projection report and the FSR, the extraction of CMM gas (35% concentration) in Yuecheng coalmine is: 239,670,000 cubic meters per year, which is 83,884,500 pure methane per year, therefore

ME_k = Methane extracted on day *k* (tCH_4) = 83,884,500/365=229,820,55 cubic meters

According to the project FSR, the annual consumption of 35% concentration CMM gas in the proposed project is 109,710,000 cubic meters, which is 38,398,500 cubic meters pure methane, therefore

$MM_{ELEC,k}$ =Methane measured sent to power plant on day *k* (tCH_4) = 38,398,500/365 = 105,201.37 cubic meters

The proposed project is a power generation project, not a cogeneration project, therefore
$MM_{HEAT,k}$ = Methane measured sent to new heat generation uses on day k in the Project Scenario that would not have been sent in the Baseline Scenario on day k (tCH4) = 0

229,820.55 – (105,201.37 + 0) = 124,619.18 > 22,480

Therefore, there is no leakage in the project.

4. Emission reductions
$ER_y = BE_y - PE_y - LE_y$
= 630,515 – 73,096 - 0
= 557,419tCO_2e/year

B.6.4 Summary of the ex-ante estimation of emission reductions:
>>

Year	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
1/12/2012-31/12/2012	4,873	42,034	0	37,161
2013	59,695	514,922	0	455,226
2014	73,096	630,515	0	557,419
2015	73,096	630,515	0	557,419
2016	73,096	630,515	0	557,419

2017	73,096	630,515	0	557,419
2018	73,096	630,515	0	557,419
2019	73,096	630,515	0	557,419
2020	73,096	630,515	0	557,419
2021	73,096	630,515	0	557,419
1/1/2022 - 30/11/2022	67,005	577,972	0	510,967
Total (tCO_2e)	**716,341**	**6,179,048**	**0**	**5,462,707**

B.7 Application of the monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

Many parameters listed in the methodology are related only to thermal or mechanical processes not involved in the project activity, or the utilization of CBM or VAM, neither of which is related to the project activity. To avoid confusion, parameters not used in the calculation of the emissions reductions of the proposed project have not been included in the table below.

Data / Parameter:	MM_{ELEC}
Data unit:	tCH_4
Description:	Methane sent to power generators
Source of data to be used:	Measured by gas meters to be installed onsite, mass is calculated using the methane density 0.00067 tCH_4/ m^3CH_4
Value of data applied for the purpose of calculating expected emission reductions in section B.5	25,727 tCH_4
Description of measurement methods and procedures to be applied:	Continuous monitoring and monthly recording, flow meters that comply with relevant standards and requirements will be used.
QA/QC procedures to be applied:	Flow meters are to be checked monthly and calibrated annually to ensure accuracy. Total flow data will be crosschecked with mine drainage data if required.
Any comment:	Flow meter will record gas flow, pressure and temperature. CH_4 concentration meter will record methane concentration. Density of methane under normal conditions of temperature and pressure is 0.67kg/m^3 (Reversed 1996 IPCC reference manual P1.24 and 1.16)

Data / Parameter:	PC_{CH4}
Data unit:	%
Description:	Concentration (in mass) of methane (wet basis) in drained gas
Source of data to be used:	Measurements at the inlet to the power generation plant (following treatment) by a concentration sensor device installed on the gas pipeline
Value of data applied for the purpose of	35%

calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Daily monitoring and monthly recording, meters in compliance with relevant standards and requirements will be used. This parameter will be used in the calculation of the methane used for electricity production, $MM_{ELEC,y}$.
QA/QC procedures to be applied:	Monitoring devices are to be checked monthly and calibrated annually to ensure accuracy. Monitored data will be crosschecked with CMM drainage data from the coalmine if required.
Any comment:	Measured on a wet basis

Data / Parameter:	PC_{NMHC}
Data unit:	%
Description:	NMHC (by mass) concentration in extracted CMM
Source of data to be used:	Will be determined from annual tests of samples of coal mine gas
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not applicable at this stage because the sum of all non-methane hydrocarbons in gas samples is less than 1% and therefore can be ignored.
Description of measurement methods and procedures to be applied:	Annually monitoring and recording, samples of gas will be extracted into gas sampling bottles using the appropriate procedures and analyzed by an accredited laboratory, for example, TES Bretby in the UK or an equivalent in China.
QA/QC procedures to be applied:	A minimum of 3 samples will be collected in secure gas bottles, suitable for storage and transport to the selected laboratory. The bottles will be filled by following the manufacturer's procedures. If one or more samples are found to be faulty (i.e. leaked) replacement samples will be taken. Scanned copies of the analyses will be backed up and archived in two different locations, where they will be stored for a period of two years after the crediting period or two years after the last issuance of CER's.
Any comment:	-

Data / Parameter:	GEN_y
Data unit:	MWh
Description:	Net electricity generated by the project in year y
Source of data to be used:	Monitored data from installed ammeters.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	103,680 MWh according to FSR
Description of measurement methods and procedures to be applied:	The readings of electricity meter will be continuously measured and monthly recorded. Automatic measurement and automatic recording will be made by computers. Double checking by the receipt of electricity sales.

QA/QC procedures to be applied:	The uncertainty level of this data is low. The meters will be installed following manufacturers' instructions. The measurement/ monitoring equipment should adopt the colligated automation system complying with national standard and technology. These equipment and systems should be calibrated and checked every year.
Any comment:	Monitoring point will be at the transformer station where the project connects to the grid as per Figure B.7-2.

Data / Parameter:	$GEN_{PJ\ to\ Yuecheng,y}$
Data unit:	MWh
Description:	Annual electricity sent to Yuecheng Coalmine
Source of data used:	Readings from Ammeter on electricity supply line to Yuecheng Coal mine
Value of data applied for the purpose of calculating expected emission reductions in section B.5	3,600MWh (based on FSR)
Description of measurement methods and procedures to be applied:	Continuously monitoring and monthly recording.
QA/QC procedures to be applied:	Electricity meter will be subject to regular (in accordance with stipulation of the meter supplier) maintenance and testing to ensure accuracy.
Any comment:	-

Data / Parameter:	$CONS_{ELEC,PJ}$
Data unit:	MWh
Description:	Additional electricity consumption by the project
Source of data used:	Project Site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	According to the FSR, $CONS_{ELEC}$ is estimated to be 10% of the power generated by the CMM power plant. With annual power generation of 115,200MWh, the project own consumption is estimated with 11,520 MWh.
Description of measurement methods and procedures to be applied:	Continuously monitoring and monthly recording.
QA/QC procedures to be applied:	Electricity meter will be subject to regular (in accordance with stipulation of the meter supplier) maintenance and testing to ensure accuracy.
Any comment:	-

Data / Parameter:	CEF_{NMHC}
Data unit:	$tCO_2/tNMHC$
Description:	Carbon emission factor for combusted non methane hydrocarbons
Source of data used:	To be obtained through annual analysis of the fractional composition of captured gas. If NMHC concentration is less than 1%, its emissions can be ignored.
Value of data applied for the purpose of	0

calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	To be obtained through annual analysis of the fractional composition of captured gas. If NMHC concentration is less than 1%, its emissions can be ignored.
QA/QC procedures to be applied:	Conducted by a qualified independent laboratory.
Any comment:	-

B.7.2 Description of the monitoring plan:

>>

A monitoring plan will be implemented to ensure that the approved monitoring methodology ACM0008 (Version 07) is correctly implemented in order to enable the accurate and transparent determination of avoided emissions. The plan will incorporate the QA/QC procedures described in 7.1 above.

1. Parameters to be monitored

The following parameters will be monitored:

- Volume of methane sent to power generators (MM_{ELEC});
- Percentage of pure methane (wet basis) in drained gas (by volume)(PC_{CH4});
- Electricity generation by the proposed project in year y (GEN_y);
- Additional electricity consumption by the project ($CONS_{ELEC,PJ}$);
- NMHC concentration in coal mine methane (PC_{NMHC}) to be monitored once a year.

2. Management structure for the implementation of monitoring plan

A specific CDM department will be established by the project owner and a CDM manager will be appointed with responsibility for the implementation of the monitoring plan. The structure for the CDM department is shown below.

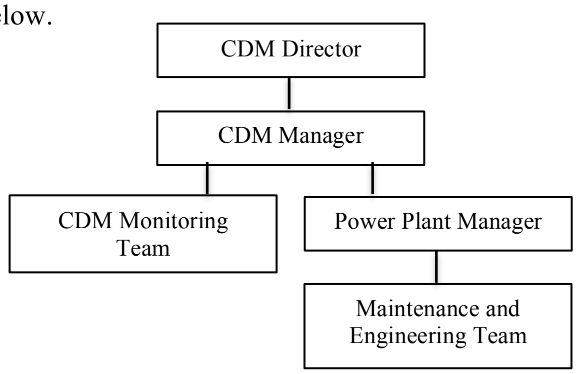

Figure B.7-1 Management structure for the proposed CDM project

All monitored data will be checked and signed off by the CDM manager who will also be responsible for preparing documents required for verification. In addition, the CDM manager will arrange for an audit of the management system periodically and at least once per year. The auditor will not be involved in the daily operation of the power plant and if necessary, may be sourced from a third party. The auditor will assess the implementation of the monitoring procedure and the preparation of the monitoring report. Audit findings, and steps taken to address findings will be recorded and reviewed in a Management Review

meeting (convened at least annually) at which time the effectiveness of these procedures will be reviewed and necessary changes implemented.

A CDM monitoring team will have day to day responsibilities for checking instrumentation, record keeping, data handling and data processing, filing, reporting, organizing maintenance and repair of monitoring equipment and ensuring the monitoring plan is adhered to as indicated in the approved methodology. The monitoring staff will receive technical and safety training. At least one member of the monitoring team who has undergone all necessary training courses will be present on every shift.

The PO, through the CDM monitoring team, will use relevant media and industry publications to stay abreast of applicable legal and regulatory requirements facing the utilization of CMM.

3. Monitoring equipment and its installation
The locations of methane flow monitoring and electric energy metering to the CMM utilization plant are shown in Figure B.7-2 below.

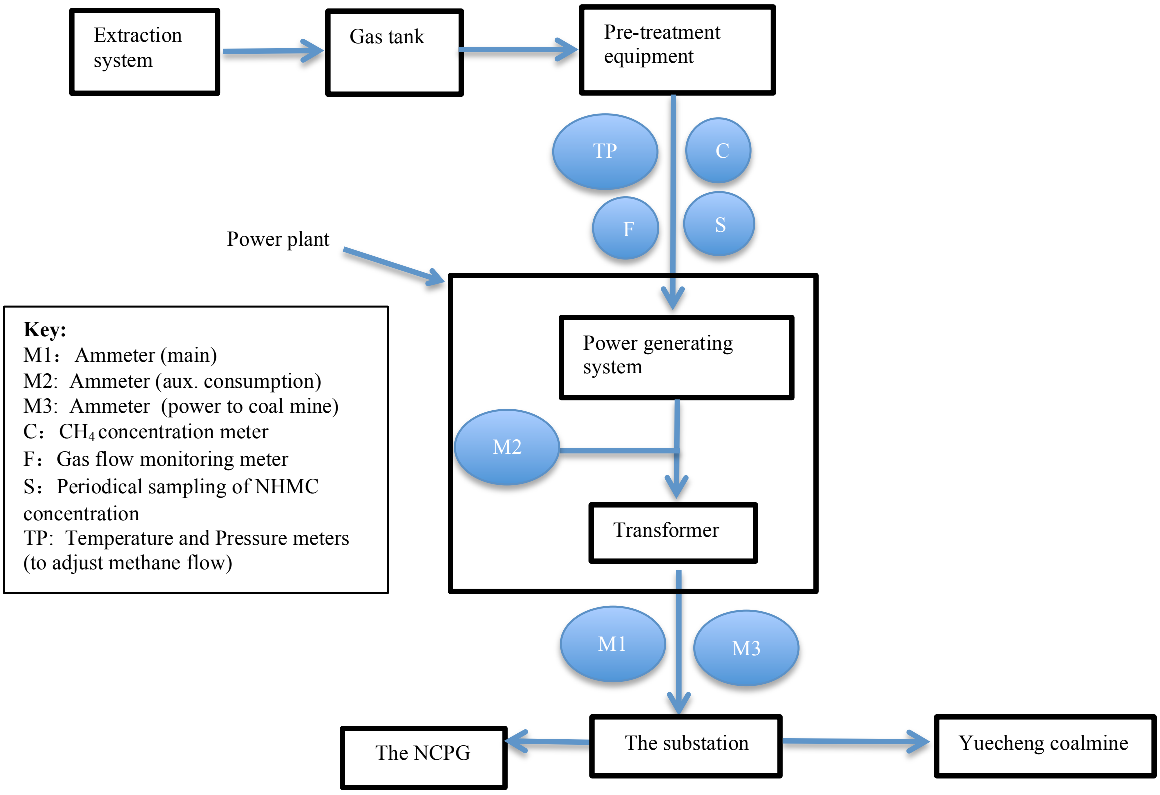

Figure B.7-2 Schematic figure on monitoring system

4. Measurement of Accuracy
The proposed project is still under construction; therefore the measurement equipment for the project has not yet been acquired. However, all the monitoring meters to be purchased and installed by the project participant will meet the relevant industry and national standards for measurement accuracy.

5. Data collection and management
The instruments installed in the proposed project include electricity meters, concentration meters and flow

meter. All instruments will be in compliance with relevant national/sectoral standards and will be calibrated and maintained in accordance with the manufacturers' instructions and relevant national/sectoral standards. All relevant records will be kept for check. The following gives explanation respectively for electricity meters, concentration meters and flow meter.

- Electricity meters

The electricity meters will be equipped according the requirements of the "*Verification Regulation of Electrical Energy Meters with Electronics (JJG596-1999)"*. The project will install meters on the high voltage side (i.e. grid side) of the transformer. Main meter M1 (with a back-up meter) will be used to measure the net electricity generated by the project and supplied to the local power grid company. Meter M2 will be installed to measure the auxiliary consumption of the plant, and meter M3 will be installed to measure any electricity supplied to Yuecheng coalmine. The accuracy of meters will rely on requirements of national/ industry standard.

The project owner is responsible for the installation of meters, and the local power grid company takes charge of checking and supervision. The meters should be examined and undergo regular calibration according to relevant standards and regulations of the power industry so as to ensure the accuracy. If any meter requires repair due to the inaccurate readings beyond the error range or the breakdown of the meters, the project owner and the grid corporation should jointly commission a qualified metering verification institution to make tests while the two parties should keep records on calibration and maintenance.

The settlement of electricity between the project owner and the gird company is based on monthly reading of the main meter. Once the accuracy of main meter fails beyond the accepted range, data from the back-up meter will be used.

- Concentration meters and flow meter

The concentration meters and flow meter will be installed at the inlet of the generators. The flow meter measures the CMM entering the generators continuously. The concentration meters are adopted daily to measure the concentration of methane (in mass) in extracted gas (%, on wet basis). The concentration meters are adopted annually to measure the concentration of NMHC (in mass) in extracted gas (%, on wet basis). The personnel of the proposed project should record and collect the readings of the two instruments. Spot readings of other values (methane content, temperature and pressure) will also be recorded periodically and at the times when flow meter readings are taken. The instruments measuring these parameters will be calibrated according to the manufacturers' instructions and meet relevant national/sectoral standards for accuracy.

- Archiving of data

Electronic documents will be saved on disk for backup and written documents will be safely kept in storage. All information related to monitoring such as meeting minutes, data documents, maintenance records, failure reports, paper documents as well as computer records, should be kept in an orderly way at a designated location. This data will be stored until 2 years after the end of the crediting period or the last issuance of CER's, whichever occurs later.

- Reporting Procedures
    - Internal reporting - The CDM monitoring team is responsible for reporting defects and corrective action to the CDM Manager. The CDM Manager will then provide senior management with monthly progress, annual audit and monitoring reports.
    - External reporting - The CDM Director will circulate an annual audit, monitoring performance through quarterly progress reports to the developer and buyers as required. The CDM Director will

finish the monitoring report two weeks before periodic verification. The report will be in English and signed by the top management before being submitted to the DOE.

6. Maintenance and calibration of meters
Maintenance and calibration on all monitoring meters will be in compliance with relevant national/sectoral standards. An archive should be established for each meter. The content of the archive should include the location of the meter, serial number, calibration information (when last calibrated, when next due for calibration) and the name of the operator who has performed the calibration. Calibration certificates will be retained for all meters until two years after the end of the crediting period.

All metering equipment for monitoring will be chosen in accordance with CDM requirements and will be serviced by a qualified third party institute or returned to the manufacturer for maintenance and calibration. The specific technical and calibration standards to be applied to each meter will be in line with manufacturer recommendations.

Installed electricity meters will fulfill the requirements of "*Verification Regulation of Electrical Energy Meters with Electronics (JJG596-1999)*". A qualified and certified power measurement and inspection organization, entrusted jointly by the project owner and the grid company will undertake the testing of installed meters.

Annual testing by a third party institute will be used to monitor the NMHC concentration in the extracted gas. To assist future verifications, the PO will preserve the historical records from each subsequent testing.

7. Treatment of missing or corrupted data
Where data in the on-line system are corrupted or missing whilst the generators are operating (as shown, for example, by electricity output) the missing data can be estimated by taking the lower of the average value for the parameter in question in the hour before the error arose or the hour immediately after the system came on-line again. If there is evidence to suggest that both of these values are un-representative, the average from the previous 24 hours will be used.

The error will be recorded in the daily log sheet and the occurrence of the error will be investigated and rectified as soon as possible. If the on-line system is compromised for more than 24 hours, data will be manually recorded.

Any deficiencies in methane flow monitoring data will be rectified by back calculation from power generation data.

8. Preparation of monitoring report
A monitoring report will be prepared by CDM department at certain periods, which can be viewed as summary of monitoring work for the monitoring period. The content of the monitoring report should include data monitoring and checking; calculation of emission reductions and record on maintenance and calibration of monitoring meters.

A monitoring manual will be implemented to ensure that the approved methodology ACM0008 version 07 is correctly implemented in order to ensure the accuracy and transparency of emission reductions. The document will incorporate the QA/QC procedures described in 7.1 above.

B.8 Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

>>
Date of completion of baseline and monitoring study: 25/03/2011

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The mentioned persons and entity here is not the project participants.

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>>
29/04/2011 (Equipment contract signed)

C.1.2. Expected operational lifetime of the project activity:

>>
11 years

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

>>
N/A

C.2.1.2. Length of the first crediting period:

>>
N/A

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
01/12/2012 or date of registration, whichever is later.

C.2.2.2. Length:

>>
10 years

SECTION D. Environmental impacts

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

>>
Under the law of environmental protection of China, the Environmental Impact Assessment of the project activity has been carried out by Environmental Protection Institute of Jincheng. Environmental Protection Bureau of Jincheng city has approved the EIA on July20th 2010 (Approval No.[2010] 83 and No.[2010] 84).

According to the EIA, the environmental impacts of the project activity and the corresponding controlling measures include:

1. Noises
The source of noise in construction period is mainly from construction machinery, which is usually between 80 to 95 dB(A). The source of noise in operation period is mainly from generator sets, compressor, pump and venting port, which is usually between 70 to 90 dB(A).

Construction machinery with low noise level will be selected. Machinery with high noise level, such as pile engine, will not be allowed working during the night. The implementation of these measures will effectively reduce the noise level within the construction site during construction period. Equipment with low noise level will be used during operation period. Noise control measures like absorption and isolation as well as vibration absorption will be taken during operation period. The generator sets used by this project are enclosed in a cargotainer. The inner side of the cargotainer wall is covered with acoustical material. The beds on which the generator sets and the cargotainer are installed are equipped with damping device. Noise absorption device is installed at air inlet. Noise abatement device is installed at the exhaust port. The compressor is equipped with damping device and installed within a house, so that noise can be reduced as much as possible. Trees will be planted around the plant, which will reduce the influence to the environment by the noise.

After these measures being taken, the noise level within the plant can meet "Standard of noise at boundary of industrial enterprises-category III" (GB12348-90), namely: 65dB(A) for daytime and 55dB(A) for the night.

2. Sewage
The purpose on which water is used by this project is the supply of cooling water. The closed circulation cooling system is utilized, which makes the cooling water be recycled and not discharged. Little domestic sewage will be created and will be used for vegetation purposes. As a result, there will be no impact to surrounding water sources.

3.Air Pollution
The pollutant in the construction period is dust, which stems from transportation of construction materials and digging activity within the construction site. CMM belongs to clean energy, the composition of which includes CH_4, N_2, O_2, excluding H_2S and dust. The flue gas created during operation period doses not contain SO_2 and dust. Main pollutant is NOx.

The soil and stone created in digging activity should be reused for refilling the pits in order to minimize the amount of taken soil. Dust from loose surface in construction period will be effectively abated by timely pressing the surface by a roller. With filtering device being used before CMM and air entering the gas

engine, the content of dust in the flue gas can be effectively reduced. Through adjusting the ratio of CMM to air, and controlling the combustion temperature within the cylinder, the NOx contents of the flue gas can be controlled. After these measures being taken, the emission of dust, SO_2 and NOx can meet the requirement stipulated in "Limits and measurement methods for exhaust pollutants from compression ignition and gas fuelled positive ignition engines of vehicles （Ⅲ, Ⅳ, Ⅴ）" (GB17691-2005).

4. Solid waste

Solid waste created during construction period mainly includes abandoned construction materials; solid waste during operation period mainly includes domestic garbage.

Measures taken includes: covering the vehicle to prevent construction materials from being lost during transportation, removing abandoned construction materials after construction being finished and sending domestic garbage to a landfill.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

>>

The EIA concludes that "The proposed project is in compliance with the national policies of industrial development, energy resource and environmental protection".

As shown above the environmental impacts of the project are not substantial.

SECTION E. Stakeholders' comments

E.1. Brief description how comments by local stakeholders have been invited and compiled:

>>

The major local stakeholders are the residents living near Yuecheng coal mine. In Oct 2010, the project owner made announcement by posting it near Yuecheng coal mine. The announcement introduced the Project in general and said stakeholder's opinions on the construction of the Project will be collected by questionnaires. The project owner sent employees distribute questionnaires to the residents living around the coal mines and the staffs from Yuecheng coalmine and power plant. A total of 40 questionnaires were distributed according to the principle of representation and randomness in order to reflect the public opinions and concerns. 40 valid questionnaires were returned after the survey, and the returning rate is 100%.

Contents of the questionnaire:

1) Whether the project is understood;
2) Whether the project is constructed;
3) Negative or positive effect to local economy and environment;
4) Are there ecologically sensitive areas near the project?
5) What environmental effect brings by the project? eg. Noise, dust, water pollution and so on;
6) Are you satisfied with environmental measures taken in this project;
7) Do you think this project can effect local people;
8) Do you support this project;
9) Any suggestions or comments for this project;

E.2. Summary of the comments received:

>>

The project site in the remote rural area, the geographical barriers influenced the telecommunications, so the project owners choose the method of questionnaire to survey. The PO send the questionnaires to the nearest villages Zhaozhuang Village and Xiaozhuang Village, then the village communities noticed the villagers through the broadcast to ask some villagers join the survey of the proposed project voluntarily. There were assigned people responsible for the recording of questionnaires and gathering the comments and suggestions. There are 9 terms in the questionnaire. The number of the questionnaires released this time is 40, and 40 questionnaires were reclaimed; the reclaim rate is 100%.

Table E.2-1 Structure of the respondents

Structure of gender		
Gender	No.	Percentage (%)
Male	30	75%
Female	10	25%

Structure of educational level		
Educational level	No.	Percentage (%)
Elementary school	10	25%
Senior middle school	24	60%
Junior middle school	6	15%

Structure of age		
Age	No.	Percentage (%)
20~30	10	25%
31~40	20	50%
41~50	8	20%
Over 50	2	5%

Comments received are as follows:

1) 100% stakeholders know this project well, 30% of them know it well;
2) 100% represents think this project is important to construct;
3) 100% represents think this project has positive effect to local economy and environment;

4) 100% represents think there isn't ecologically sensitive area near this project;
5) 100% represents think this project brings no environmental effect;
6) 100% represents think the environmental protection measures in this project is acceptable;
7) 100% represents think this project is beneficial to local people, 90% of them think the project provide job opportunity;
8) 100% represents support this project;
9) 100% represents consider the project should speed project construction to reduce the environment impact during construction period.

It can be concluded from the above results that local residents expressed high support for the project as it has no adverse environmental impacts to the surrounding area. The feedbacks from local residents were almost all positive as their daily life would not be influenced by the project activity. This project can decrease the emission of CMM with no negative impacts on local residents and create new job opportunities. Local residents agree the construction of this project.

E.3. Report on how due account was taken of any comments received:

>>

No additional action was required as no comments raised.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding from Annex I Parties for this Project.

Annex 3

BASELINE INFORMATION

Calculation of Emission Factor in North China Power Grid

1. Calculation of the simple Operating Margin (*OM*) Emission Factor

Table A1. Total Emissions of the North China Power Grid in 2006

Fuel Type	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total	Emission Factor	Oxidate Rate	Fuel emission factor	Low Caloric Value ($MJ/t,m^3,tce$)	CO_2 Emission (tCO_2e)
									(tc/TJ)	（%）	($kgCO_2$ /TJ)	($MJ/t,km^3$)	**L=G×J×K/100000(m)**
		A	B	C	D	E	F	G=A+B+C+D+E+F	H	I	**J**	**K**	**L=G×J×K/10000 (m)**
Raw Coal	10^4t	796.63	1639.2	6867.99	6968.88	8404.05	10930.66	**35607.41**	25.8	100	87,300	20,908	649,930,803
Cleaned Coal	10^4t						39.77	**39.77**	25.8	100	87,300	26,344	914,643
Other Washed Coal	10^4t	6.36		214.13	371.14	61.77	544.6	**1198**	25.8	100	87,300	8,363	8,746,477
Briquette	10^4t	7.97					27.77	**35.74**	26.6	100	87,300	20,908	652,351
Coke	10^4t						3.23	**3.23**	29.2	100	95,700	28,435	87,896
Coke Oven Gas	10^8m^3	0.38	0.63	5.8	22.32	0.64	5.79	**35.56**	12.1	100	37,300	16,726	2,218,517
Other Gas	10^8m^3	20.66	6.58	69.72	13.79	22.76	7.22	**140.73**	12.1	100	37,300	5,227	2,743,772
Crude Oil	10^4t					0.74		**0.74**	20	100	71,100	41,816	22,001
Gasoline	10^4t			0.01				**0.01**	18.9	100	67,500	43,070	291
Diesel	10^4t	0.21		3.01		0.07	6.32	**9.61**	20.2	100	72,600	42,652	297,577
Fuel Oil	10^4t	6.38		0.08			4.1	**10.56**	21.1	100	75,500	41,816	333,391
PLG	10^4t						0.01	**0.01**	17.2	100	61,600	50,179	309
Refinery Gas	10^4t			2.43			2.32	**4.75**	15.7	100	48,200	46,055	105,443
Natural Gas	10^8m^3	3.41	0.73		0.53			**4.67**	15.3	100	54,300	38,931	987,216
Other petroleum Products	10^4t						0.28	**0.28**	20	100	75,500	41,816	8,840
Other Coking Products	10^4t							**0**	25.8	100	95,700	28,435	0
Other Energy	10^4tce	6.83		47.11	230.76	12.51	132.29	**429.5**	0	0	0	0	0
												Total	667,049,525

Data sources: China Energy Statistical Yearbook 2007

Table A 2. Thermal Power Generation of the North China Power Grid in 2006

	Electricity Generation (MWh)	Used by the Power Plant (%)	Electricity supplied to the Grid (MWh)
Beijing	20,705,000	7.51	19,150,055
Tianjin	35,924,000	6.86	33,459,614
Hebei	143,888,000	6.63	134,348,226
Shanxi	150,250,000	7.45	139,056,375
Inner Mongolia	139,593,000	7.58	129,011,851
Shandong	230,922,000	7.12	214,480,354
Total	721,282,000		**669,506,473**

Data sources: The State Electric Industry Yearbook 2007; China Energy Statistical Yearbook 2007

The North China Power Grid imported 2,618,060MWh electricity from the North East Power Grid in 2006, and the emission factor of the North East Power Grid in 2006 is 1.14972 tCO_2e/MWh.

The North China Power Grid imported 497,060MWh electricity from the Central China Power Grid in 2006, and the emission factor of the Central China Power Grid in 2006 is 1.12157 tCO_2e/MWh.

Table A 3. *OM* Emission Factor of the North China Power Grid in 2006

Electricity supplied to the Grid (MWh)	Total emission (tCO_2e)	OM (tCO_2e/MWh)
672,621,593	670,617,037	0.99702

Table A4. Total Emissions of the North China Power Grid in 2007

Fuel Type	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total	Emission Factor	Oxidate Rate	Fuel emission factor	Low Caloric Value ($MJ/t,m^3$,tce)	CO_2 Emission (tCO_2e)
									(tc/TJ)	（%）	**($kgCO_2$ /TJ)**	**($MJ/t,km^3$)**	**L=G×J×K/100000(m)**
		A	B	C	D	E	F	G=A+B+C+D+E+F	H	I	**J**	**K**	**L=G×J×K/10000 (m)**
Raw Coal	10^4t	816.17	1753.99	7716.13	7510.06	10434.25	11884.83	**40115.43**	25.8	100	87,300	20,908	732,214,267
Cleaned Coal	10^4t						18.43	**18.43**	25.8	100	87,300	26,344	423,859
Other Washed Coal	10^4t	5.76		156.89	478.81	48.57	756.84	**1446.87**	25.8	100	87,300	8,363	10,563,452
Briquette	10^4t	7.93					42.86	**50.79**	26.6	100	87,300	20,908	927,054
Coke	10^4t			0.02			4.09	**4.11**	29.2	100	95,700	28,435	111,843
Coke Oveb Gas	10^8m^3	0.07	0.72	3.13	25.46	2.58	13.61	**45.57**	12.1	100	37,300	16,726	2,843,020
Other Gas	10^8m^3	11.8	7.6	88.38	72.8	28.17	29.64	**238.39**	12.1	100	37,300	5,227	4,647,821
Crude Oil	10^4t							**0**	20	100	71,100	41,816	0
Gasoline	10^4t			0.01				**0.01**	18.9	100	67,500	43,070	291
Diesel	10^4t	0.33		2.35		0.62	5.08	**8.38**	20.2	100	72,600	42,652	259,490
Fuel Oil	10^4t	4.74		0.18			2.35	**7.27**	21.1	100	75,500	41,816	229,522
PLG	10^4t							**0**	17.2	100	61,600	50,179	0
Refinery Gas	10^4t	0.06		2.85			1.65	**4.56**	15.7	100	48,200	46,055	101,225
Natural Gas	10^8m^3	5.03	0.73		0.54	4.22	0.01	**10.53**	15.3	100	54,300	38,931	2,225,993
Other petroleum Products	10^4t	1.72						**1.72**	20	100	75,500	41,816	54,302
Other Coking Products	10^4t	4.74						**4.74**	25.8	100	95,700	28,435	128,986
Other Energy	10^4tce	11.94		77.25	360.26	30.75	163.48	**643.68**	0	0	0	0	0
												Total	754,731,124

Data sources: China Energy Statistical Yearbook 2008

Table A 5. Thermal Power Generation of the North China Power Grid in 2007

	Electricity Generation (MWh)	Used by the Power Plant (%)	Electricity supplied to the Grid (MWh)
Beijing	22,300,000	7.51	20,625,270
Tianjin	39,900,000	6.53	37,294,530
Hebei	163,300,000	6.67	152,407,890
Shanxi	173,400,000	7.99	159,545,340
Inner Mongolia	180,100,000	7.77	166,106,230
Shandong	259,100,000	7.23	240,367,070
Total	838,100,000		776,346,330

Data sources: The State Electric Industry Yearbook 2008

The North China Power Grid imported1, 789,750MWh electricity from the North East Power Grid in 2007, and the emission factor of the North East Power Grid in 2007 is 1.08186 tCO_2e/MWh.

The North China Power Grid imported 803,000MWh electricity from the Central China Power Grid in 2007, and the emission factor of the Central China Power Grid in 2007 is1.10197 tCO_2e/MWh.

Table A 6. *OM* Emission Factor of the North China Power Grid in 2007

Electricity supplied to the Grid (MWh)	Total emission (tCO_2e)	OM (tCO_2e/MWh)
778,939,080	757,552,268	0.97254

Table A7. Total Emissions of the North China Power Grid in 2008

Fuel Type	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total	Emission Factor	Oxidate Rate	Fuel emission factor	Low Caloric Value (MJ/t,m^3,tce)	CO_2 Emission (tCO_2e)
									(tc/TJ)	(%)	($kgCO_2$ /TJ)	(MJ/t,km^3)	L=G×J×K/100000 （M）
		A	B	C	D	E	F	G=A+B+ C+D+E+F	H	I	J	K	L=G×J×K/10000 (V)
Raw Coal	10^4t	755.75	1800.12	7353.33	7854.39	12607.82	12360.75	**42732.16**	25.8	100	87,300	20,908	779,976,613
Cleaned Coal	10^4t						23.88	**23.88**	25.8	100	87,300	26,344	549,200
Other Washed Coal	10^4t	5.05		134.52	582.39	66.2	691.21	**1479.37**	25.8	100	87,300	8,363	10,800,731
Coke	10^4t	5.66			32.49		45.38	**83.53**	26.6	100	87,300	20,908	1,524,647
Coke Oveb Gas	10^8m^3			0.02			6.07	**6.09**	29.2	100	95,700	28,435	165,723
Other Gas	10^8m^3	0.11	0.86	8.37	24.55	3.55	16.2	**53.64**	12.1	100	37,300	16,726	3,346,491
Crude Oil	10^4t	10.4	9.08	187.54	36	34.32	29.76	**307.1**	12.1	100	37,300	5,227	5,987,440
Gasoline	10^4t					0.02		**0.02**	20	100	71,100	41,816	595
Diesel	10^4t							**0**	18.9	100	67,500	43,070	0
Fuel Oil	10^4t	0.15		3.08		0.35		**3.58**	20.2	100	72,600	42,652	110,856
PLG	10^4t	2.56		0.25				**2.81**	21.1	100	75,500	41,816	88,715
Refinery Gas	10^4t							**0**	17.2	100	61,600	50,179	0
Natural Gas	10^8m^3	0.44		2.93				**3.37**	15.7	100	48,200	46,055	74,809
Other Petroleum Products	10^4t	11.09	0.7		0.97	2.12		**14.88**	15.3	100	54,300	38,931	3,145,563
Other Coking Products	10^4t	1.45						**1.45**	20	100	72,200	41,816	43,777
Other Energy	10^4tce	7.97		7.61				**15.58**	25.8	100	95,700	28,435	423,968
												total	806,239,126

Data sources: China Energy Statistical Yearbook 2009

Table A8. Thermal Power Generation of North China Power Grid in 2008

	Electricity Generation (MWh)	Used by the Power Plant (%)	Electricity supplied to the Grid (MWh)
Beijing	243	24,300,000	7.14
Tianjin	397	39,700,000	7.05
Hebei	1580	158,000,000	6.9
Shanxi	1762	176,200,000	8.22
Inner Mongolia	2008	200,800,000	7.96
Shandong	2689	268,900,000	7.14
Total	867,900,000		**802,797,350**

Data sources: The State Electric Industry Yearbook 2009

The North China Power Grid imported 5,286,140MWh electricity from the North East Power Grid in 2008, and the emission factor of the North East Power Grid in 2005 is 1.10489 tCO_2e/MWh.

Table A9. Emission Factor of North China Power Grid in 2008

Electricity supplied to the Grid (MWh)	**Total emission (tCO_2e)**	**OM (tCO_2e/MWh)**
808,083,490	812,079,707	1.00495

The averaged three years 'Emission Factor is: $EF_{OM,y}$ =0.9914tCO_2e/MWh

2) Calculation of Build Margin emission factor

Calculation of λ*Coal* , λ*Oil* and λ*Gas*

Table A 10. NCV, oxidation factor and potential emission factor of each fuel

Fuel types	NCV	Emission factor **($kgCO_2/TJ$)**	Oxidation factor
Raw coal	20,908 kJ/kg	87,300	1
Cleaned coal	26,344 kJ/kg	87,300	1
Moulded coal	20,908 kJ/kg	87,300	
Other washed coal [86]	8,363 kJ/kg	87,300	1
Coke	28,435 kJ/kg	95,700	1
Crude oil	41,816 kJ/kg	71,100	1
Gasoline	43,070 kJ/kg	67,500	1
Diesel	42,652 kJ/kg	72,600	1
Fuel oil	41,816 kJ/kg	75,500	1
Other oil products	41,816 kJ/kg	75,500	1
Natural gas	38,931 kJ/m^3	54,300	1
Coke oven gas [87]	16,726 kJ/m^3	37,300	1
Other coal gas [88]	5,227 kJ/m^3	37,300	1
LPG	50,179 kJ/kg	61,600	1
Refinery gas	46,055 kJ/kg	48,200	1

[86] Calculated as per NCV of washed coal provided by China Energy Statistical Yearbook 2008 p. 283, and as the average NCV of coal slime is larger than that of washed coal, it is conservative to conduct by this way.
[87] Calculated as per the lower value of NCV range 16726-17981 kJ/m^3 of Coke oven gas provided by China Energy Statistical Yearbook 2008 p. 283.
[88] Calculated as per the lowest value of NCV of coal gas provided by China Energy Statistical Yearbook 2008 p. 283.

Data sources: the heat value of each fuel is from China Energy Statistical Yearbook 2009 p. 507-508. The potential emission and oxidation factor of each fuel are from *Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories:* Volume 2 Energy, Chapter 1, p. 1.23-1.24, Table 1.3 & 1.4.

The efficiency level of the best technology commercially available of coal-fired power in the calculation result is set as 600MW domestic subcritical generator sets. The weighted average value of coal consumption of power supply of 30 set of 600MW generator sets newly built in 2008 is taken as the estimation of the efficiency level of the best technology commercially available in the calculation result. The coal consumption of power supply of 600MW domestic subcritical power plant is estimated to be 314.35gce/kWh, which is equivalent to 39.08% of power supply efficiency.

Table A 11. Emission factor of the best power technology commercially available

	Variable	Efficiency of power supply	NCV (tc/TJ)	Oxidation factor	Emission factor (tCO_2/MWh)
		A	B	C	D=3.6/A/1,000,000×B×C
Coal-fired power plant	$EF_{Coal,Adv}$	39.08	87,300	1	0.8042
Oil-fired power plant	$EF_{Oil,Adv}$	51.46	75,500	1	0.5282
Gas-fired power plant	$EF_{Gas,Adv}$	51.46	54,300	1	0.3799

Table A 12. Calculating the proportion of solid fuel, liquid fuel and gas fuel in the total emission

Fuel Type	Unit	Beijing	Tianjin	Hebei	Shanxi	Shandong	Inner Mongolia	Total	Low Caloric Value (MJ/t,m^3,tce)	Emission Factor	Oxidate Rate	CO_2 Emission (tCO_2e)
		A	B	C	D	E	F	G=A+…+F	H	I	J	K=G×H×I×J/100,000
Raw Coal	10^4t	755.75	1,800.12	7,753.33	7,854.39	12,360.75	12,607.82	42,732.16	20,908	87,300	1	779,976,613
Cleaned Coal	10^4t	0	0	0	0	23.88	0	23.88	26,344	87,300	1	549,200
Other Washed Coal	10^4t	5.05	0	134.52	582.39	691.21	66.2	1,479.37	8,363	87,300	1	10,800,731
Briquette	10^4t	5.66	0	0	32.49	45.38	0	83.53	20,908	87,300	1	1,524,647
Coke	10^4t	0	0	0.02	0	6.07	0	6.09	28,435	95,700	1	165,723
Other Coking Products	10^4t	7.94	0	7.61	0	0	0	15.58	28,435	95,700	1	423,968
Sub-total								44,340.61				**793,440,881**
Crude Oil	10^4t	0	0	0	0	0	0.02	0.02	41,816	71,100	1	595
Gasoline	10^4t	0	0	0	0	0	0	0	43,070	67,500	1	0
Diesel	10^4t	0.15	0	3.08	0	0	0.35	3.58	42,652	72,600	1	110,856
Fuel Oil	10^4t	2.56	0	0.25	0	0	0	2.81	41,816	75,500	1	88,715
Other petroleum Products	10^4t	1.45	0	0	0	0	0	1.45	41,816	75,500	1	43,777
Sub-total								7.86				**243,942**
Natural Gas	10^8m^3	110.9	7	0	9.7	0	21.2	148.8	38,931	54,300	1	3,145,563
Coke Oveb Gas	10^8m^3	1.1	8.6	83.7	245.5	162	35.5	536.4	16,726	37,300	1	3,346,491
Other Gas	10^8m^3	104	90.8	1875.4	360	297.6	343.2	3,071	5,227	37,300	1	5,987,440
PLG	10^4t	0	0	0	0	0	0	0	50,179	61,600	1	0
Refinery Gas	10^4t	0.44	0	2.93	0	0	0	3.37	46,055	48,200	1	74,809
Sub-total								3,759.57				**12,554,302**
Total												**806,239,126**

Data sources: China Energy Statistical Yearbook 2009

According to the data and related calculation formula (4), (5), (6): λ_{Coal} =98.41%， λ_{Oil} =0.03%， λ_{Gas} =1.56%.

Hence, $EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Coal,Adv} + \lambda_{Gas} \times EF_{Gas,Adv}$ **=0.7975(tCO_2/MWh)**

Table A 13. Installed capacity of the North China Power Grid 2008

Installed capacity	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Fossil Fuelled power	MW	4,760	7,490	29,870	35,320	45,740	55,930	179,040
Hydro power	MW	1,050	0	1,540	790	830	1,050	5,260
Nuclear power	MW	0	0	0	0	0	0	0
Wind power and other	MW	0	0	700	0	2,300	370	3,370
Total	MW	5,810	7,490	32,110	36,040	48,860	57,350	187,660

Data sources: The State Electric Industry Yearbook 2009

Table A 14. Installed capacity of the North China Power Grid 2007

Installed capacity	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Fossil Fuelled power	MW	3,900	6,920	29,020	30,950	39,870	54,140	164,800
Hydro power	MW	1050	10	780	790	830	1,050	4,510
Nuclear power	MW	0	0	0	0	0	0	0
Wind power and other	MW	2.7	0	410	0	1,096.5	210	1,719.2
Total	MW	4,952.7	6,930	30,210	31,740	41,796.5	55,400	171,029.2

Data sources: The State Electric Industry Yearbook 2008

Table A 15. Installed capacity of the North China Power Grid 2006

Installed capacity	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Fossil Fuelled power	MW	3,984	6,512	26,087	26,661	28,899	49,395	141,538
Hydro power	MW	1,053	5	785	790	818	553	4,004
Nuclear power	MW	0	0	0	0	0	0	0
Wind power and other	MW	24	24	218	0	565	106	937
Total	MW	5,061	6541	27,090	27,451	30,282	50,054	146,479

Data sources: The State Electric Industry Yearbook 2007

Table A 16. BM calculation of the North China Power Grid

	Installed capacity in 2006	Installed capacity in 2007	Installed capacity in 2008	New added installed capacity 2005-2007	New added installed capacity 2005-2007	The fraction of newly added installed capacity
	A	B	C	D	E	F
Fossil Fuelled power (MW)	141,538	164,800	179,040	46,111	17,847	93.98%
Hydro power （MW）	4,004	4,510	5,260	520	9	1.06%
Nuclear power (MW)	0	0	0	0	0	0.00%
Wind power (MW)	937	1,719.2	3,370	2,433	1,651	4.96%
Total (MW)	**146,479**	**171,029.2**	**187,660**	**49,064**	**19,508**	**100.00%**
The fraction of installed capacity 2008				26.15%	10.40%	

$EF_{BM,y}$=0.7975×93.98%=0.7495tCO_2/MWh

3. Calculation of Build Margin (*C M*) Emission Factor

$EF_{CM,y}$=0.5*0.9914+0.5*0.7495=0.87045 tCO_2e/MWh

Annex 4

MONITORING INFORMATION

Monitoring will be undertaken as outlined in Section B7.2 and no more information to be provided here.